System Requirements Document
for the
Human Research Facility (HRF)
Foot Ground Interface (FGI) Flight Calibration Unit (FCU)

LS-71032-3
11/22/00 csc

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ACRONYMS AND ABBREVIATIONS

AC	Alternating Current
ADP	Acceptance Data Package
AVT	Acceptance Vibration Testing
C&DH	Command and Data Handling
COTS	Commercial-Off-the-Shelf
dB	Decibels
DBA	Acoustic Decibel Level
DC	Direct Current
DRD	Data Requirements Description
EEE	Electrical, Electronic, and Electromechanical
EMC	Electromagnetic Compatibility
EPCE	Electrical Power Consuming Equipment
ESD	Electrostatic Discharge
EUE	Experiment Unique Equipment
EVA	Extravehicular Activity
FCU	Flight Calibration Unit
fc	foot candle
FGI	Foot Ground Interface
GFCI	Ground Fault Circuit Interrupter
GPVP	Generic Payload Verification Plan
GSE	Ground Support Equipment
g rms	gravity root mean square
Hg	Mercury
HRD	Hardware Requirements Document
HRF	Human Research Facility
Hz	Hertz
ICD	Interface Control Document
IDD	Interface Definition Document
in	inch
ISS	International Space Station
IVA	Intravehicular Activity
JSC	Johnson Space Center
KHz	Kilohertz
kPa	KiloPascal

lb	pound
lbf	pounds force
MDP	Maximum Design Pressure
mm	millimeter
MPLM	Mini Pressurized Logistics Module
N	Newton
NASA	National Aeronautics and Space Administration
NSTS	National Space Transportation System
ORU	Orbital Replacement Unit
P/L	Payload
P/N	Part Number
Pa	Pascal
para.	paragraph
PDA	Pre-Delivery Acceptance
PFE	Portable Fire Extinguisher
psi	pounds per square inch
psia	pounds per square inch absolute
psig	pounds per square inch gauge
PSRP	Payload Safety Review Panel
QAVT	Qualification for Acceptance Vibration Testing
QD	Quick Disconnect
RMA	Restraint and Mobility Aid
SE&I	Systems Engineering and Integration
sec	second
SEE	Single Event Effect
SOW	Statement Of Work
SPL	Sound Pressure Level
SRD	System Requirements Document
SRM	Solid Rocket Motor
SS	Stainless Steel
STS	Space Transportation System
TBD	To Be Determined
TF-FGI	Total Force Foot Ground Interface
TPS	Task Performance Sheet

V	Volts
VC-S	Visibly Clean - Sensitive
VDS	Verification Data Sheet
V rms	Volts root mean square
ºC	Degrees Celsius
ºF	Degrees Fahrenheit

1.0 SCOPE

This specification defines the Human Research Facility (HRF) program requirements for Foot Ground Interface (FGI) Flight Calibration Unit (FCU), P/N SEG33110402-301. The FGI Flight Calibration Unit consists of Criticality 3 hardware that will be used to support the HRF.

The primary governing document for the requirements levied in this document is LS-71000A, "Program Requirements Document for the Human Research Facility." Other requirements are derived from SSP 57200, "Human Research Facility - Rack One Hardware Interface Control Document (ICD)," and interface requirement documents for the various items of HRF equipment.

The requirements in Sections 3, 4, and 5 of this document consist of a minimum set of constraints for Criticality 3 hardware and software. Criticality 3 items are defined in Section 3.2 of LS-71000A. Provisions for verification and subsequent use of Criticality 3 equipment as part of the HRF program are delineated in Section 5 of LS-71000A.

The FGI Flight Calibration Unit shall be reviewed through the Johnson Space Center (JSC) Payload Safety Review Panel (PSRP) for Safety Certification and JSC/NT3 Reliability for designation as Criticality 3 hardware.

The HRF Project Office is the controlling authority for this document. The HRF Configuration Control Board (CCB) or a delegated authority must approve any deviations from the requirements of this document. Any change in functionality that requires equipment designated as Criticality 3 to be used in a manner that is not consistent with the requirements specified herein and in LS-71000A will require that item or items to be reassessed for criticality as well as applicability of this document.

2.0 APPLICABLE DOCUMENTS

The following applicable documents of the exact issue shown herein form a part of this specification to the extent specified herein. If a revision level or date is not cited, the latest version of the document should be used.

All specifications, standards, exhibits, drawings or other documents referenced in this specification are hereby incorporated as cited in the text of this document.

2.1 DOCUMENTS

Document Number	Revision	Document Title
FED-STD-595	*Rev. B 12/89*	Colors Used in Government Procurement
JSC-SN-C-0005	Rev. C 2/89	National Space Transportation System Contamination Control Requirements
LS-71000A	Rev. A 1/00	Program Requirements Document for the Human Research Facility
MIL-STD-1686	Rev. C *10/95*	Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, (Excluding Electrically Initiated Explosive Devices)
NASA TM 102179	*6/91*	Selection of Wires and Circuit Protective Devices for STS Orbiter Vehicle Payload Electrical Circuits
NSTS/ISS 13830	*Rev. C, Ch. 1 7/99*	Implementation Procedure for NSTS Payloads System Safety Requirements
NSTS-1700.7	*Rev. B, Ch. 4 3/97*	Safety Policy and Requirements For Payloads Using the Space Transportation System
NSTS-1700.7B ISS ADDENDUM	*12/95*	Safety Policy and Requirements For Payloads Using the International Space Station
NSTS/ISS 18798	*Rev. B, Ch. 3 9/97*	Interpretations of NSTS Payload Safety Requirements
NSTS-21000-IDD-MDK	*Rev. B 02/97*	Shuttle Orbiter/Middeck Interface Definition Document Cargo Element Interfaces

Document Number	Revision	Document Title
SSP 30233	*Rev. E 11/95*	Space Station Requirements for Materials and Processes
SSP 30237	*Rev. D 7/98*	Space Station Electromagnetic Emission and Susceptibility Requirements
SSP 30243	*Rev. E, Ch. 3 6/99*	Space Station Requirements for Electromagnetic Compatibility
SSP 30312	*Rev. F 11/95*	Electrical, Electronic, and Electromechanical (EEE) and Mechanical Parts Management and Implementation Plan International Space Station Program
SSP 30512	*Rev. C 9/94*	Space Station Ionizing Radiation Design Environment
SSP 50005	*Rev. B, Ch. 1 9/98*	International Space Station Flight Crew Integration Standard (NASA-STD-3000/T)
SSP 57000	*Rev. C 12/98*	Pressurized Payloads Interface Requirements Document
SSP 57200	*Rev. A 5/99*	Human Research Facility - Rack One Hardware Interface Control Document

2.2 ORDER OF PRECEDENCE

In the event of a conflict between the text of this specification and references cited herein, the text of this specification takes precedence. Nothing in this specification, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3.0 SYSTEM REQUIREMENTS

3.1 ITEM DEFINITION

The FGI Flight Calibration Unit will be designed and certified under this requirements document for use on International Space Station (ISS) as a part of the HRF program. HRF hardware used with the FGI Flight Calibration Unit is certified under separate documentation, which is maintained by the appropriate program(s).

Table 3.1-1 lists the equipment items covered by this document, including the stowage kits that will be used to transport the items and contain the items on-orbit.

TABLE 3.1-1. FGI FLIGHT CALIBRATION UNIT EQUIPMENT

Item Name	Part Number	Notes
FGI Flight Calibration Unit	SEG33110402-301	This hardware is used to calibrate insoles for the FGI and Total Force Foot Ground Interface (TF-FGI).
Battery Kit	SED46107213-302	Replacement 9V batteries for digital pressure gauge. Battery replacement on-orbit is not anticipated to be performed.

There are no software items covered by this document.

3.1.1 Hardware Description

The FGI Flight Calibration Unit will be used to calibrate insoles for the FGI and the TF-FGI devices on the ISS.

The Flight Calibration Unit consists of two aluminum plates and a plumbing assembly. A neoprene rubber bladder is attached to one of the plates. During use, the insole to be calibrated will be inserted between the aluminum plates. The Flight Calibration Unit will be connected to the HRF Rack pressurized nitrogen supply via a Quick Disconnect (QD) and the metering valve will be used to control the flow of nitrogen to the bladder. The digital pressure gauge will be used to monitor the pressure exerted by the bladder on the insole. Three relief valves are included in the plumbing assembly to prevent rupture of the bladder due to over-pressurization.

The FGI Flight Calibration Unit is shown in Figure 3.1.1-1. A schematic diagram of the assembly is shown in Figure 3.1.1-2

3.1.1.1 Experiment Overview

The FGI Flight Calibration Unit will be used to calibrate insoles for use with the FGI hardware and the TF-FGI. The FGI and the TF-FGI will be human instrumentation system components of the HRF on board the ISS. They will provide a primary means to dynamically measure the pressure distribution and total force respectively exerted on each foot by the crewmembers during normal work,

training and exercise routines.

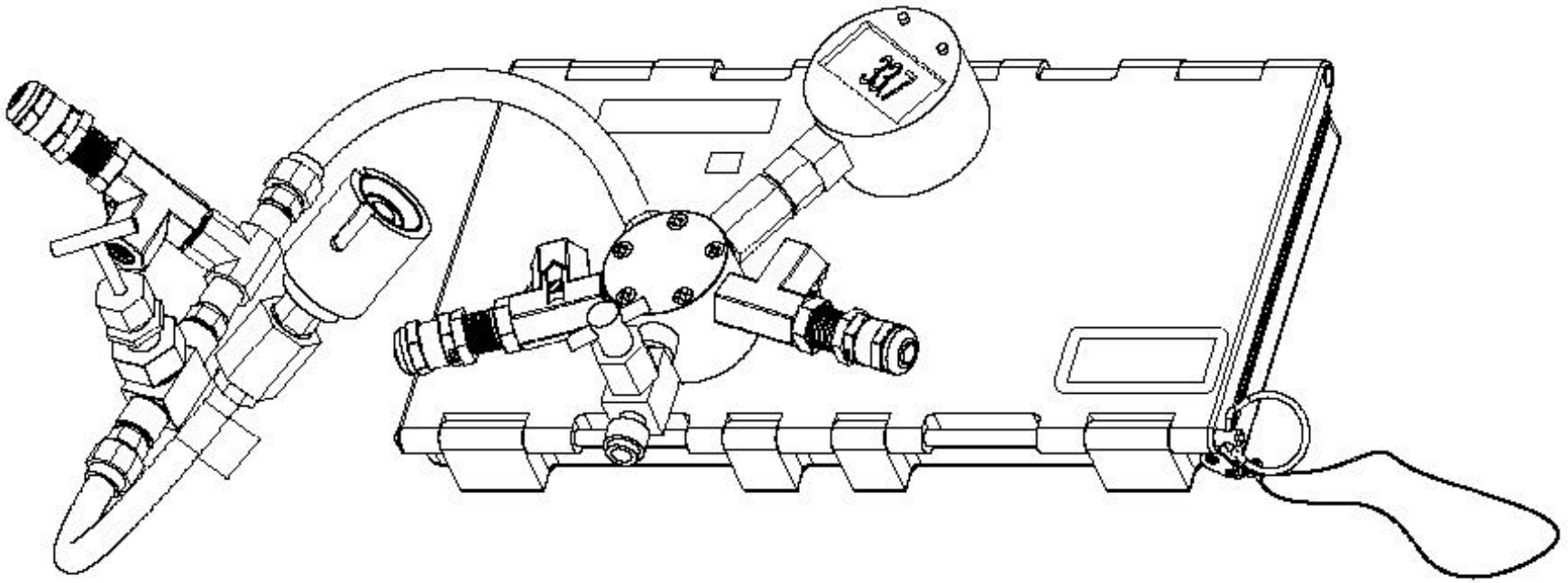


Figure 3.1.1-1. The FGI Flight Calibration Unit

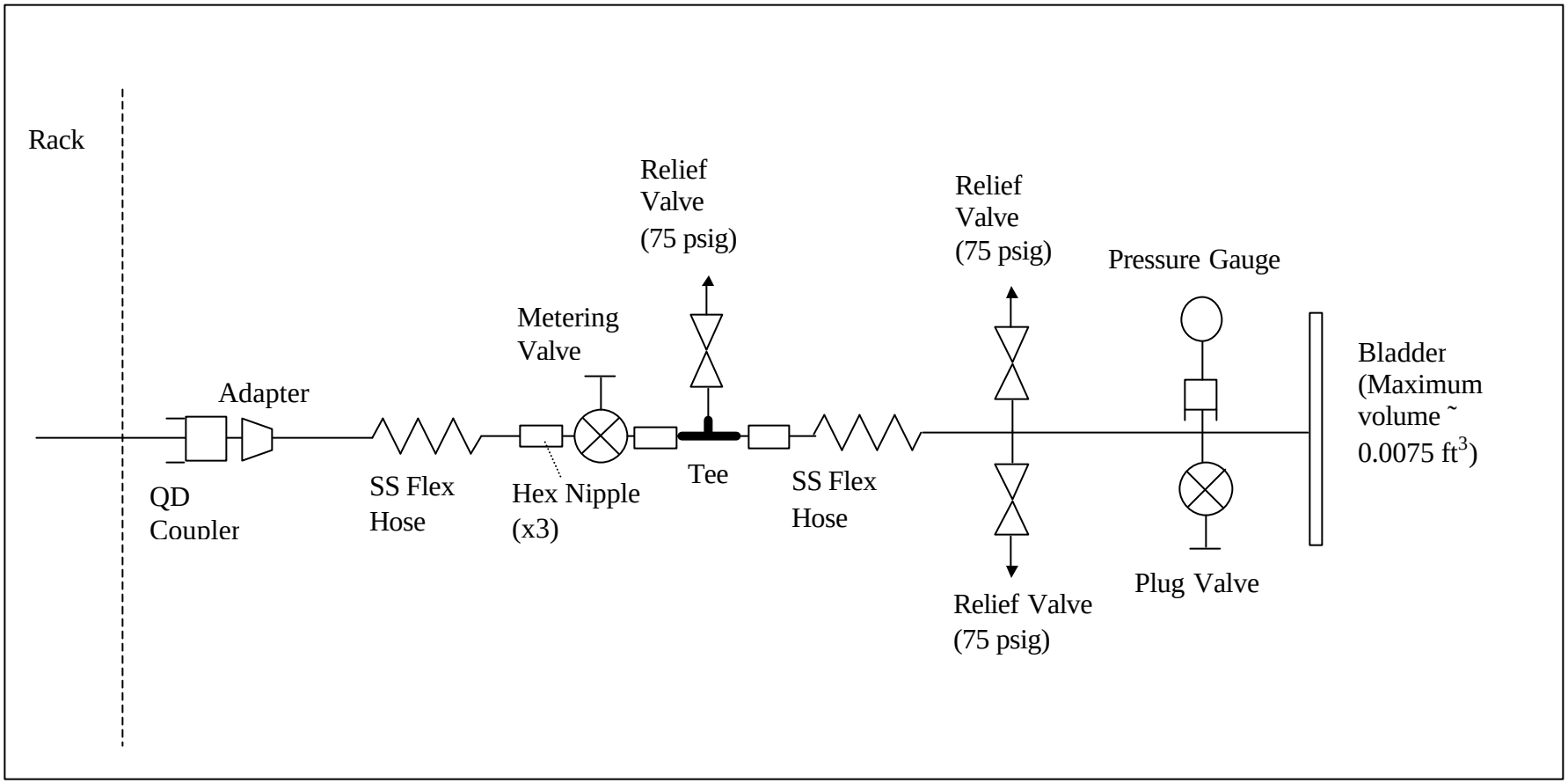


Figure 3.1.1-2. FGI Flight Calibration Unit Pressure Schematic

3.1.1.2 Operational Overview

For use, the FGI Flight Calibration Unit will be attached to the Rack seat track via an ISS multi-use bracket or similar attachment. The FGI Flight Calibration Unit will be attached to the bracket via the mounting shoe on the lower plate of the assembly. The QD will then be connected to the HRF Rack 1 nitrogen interface connector. One insole will be inserted into the device, and the lock pin will be replaced prior to pressurization. The metering valve will be used to control the flow of nitrogen from the rack. The pressure will be monitored on the digital pressure gauge. The nitrogen will be vented by opening the plug valve on the manifold.

3.2 CHARACTERISTICS

3.2.1 Performance Characteristics

3.2.1.1 Functional Performance Characteristics

A. The FGI Flight Calibration Unit shall be capable of accommodating one Novel insole in sizes ranging from P to Z (P/Ns: SEG33110422-001 to SEG33110422-022).

B. The FGI Flight Calibration Unit shall be capable of providing a stable, uniform load to the insole being calibrated. The Flight Calibration Unit shall also provide a means of releasing the pressure.

C. The FGI Flight Calibration Unit pressure range shall be from 0 to 517 kPa (0 to 75 psig).

D. The FGI Flight Calibration Unit shall provide protection against overpressurization of the neoprene bladder.

E. The FGI Flight Calibration Unit shall provide a means of displaying the pressure.

3.2.2 Physical Characteristics

3.2.2.1 Mass Properties

The mass of the FGI Flight Calibration Unit shall not exceed 21.8 kg (48 lb.).

3.2.2.2 Envelope

3.2.2.2.1 Stowed Envelope

Dimensions of the stowed FGI Flight Calibration Unit shall not exceed 16.2 in (W) x 20.32 in (D) x 5.9 in (H).

3.2.2.2.2 Deployed Envelope

3.2.2.2.2.1 On-Orbit Payload Protrusions

Definitions, for on-orbit permanent protrusions, on-orbit semi-permanent protrusions, on-orbit temporary protrusions, on-orbit momentary protrusions, and

protrusions for on-orbit keep-alive payloads can be found in Section 6.1 Definitions. The requirements in Section 3.2.2.2.2.1 apply to installation and operation activities, but not to maintenance activities.

NOTE: The on-orbit protrusion requirements in this section are applicable to when the payload is on-orbit and do not apply to other phases of the transportation of the payload (e.g., launch, landing, Mini-Pressurized Logistics Module (MPLM), installation).

The FGI Flight Calibration Unit will take exception to the following requirements:

A. On-orbit protrusions, excluding momentary protrusions, shall not extend laterally across the edges of the rack or pass between racks. (SSP 57000, Section 3.1.1.7A)

B. The hardware, excluding momentary protrusions, shall not prevent attachment of Restraint and Mobility Aid (RMA) of any seat track attach holes. (SSP 57000, Section 3.1.1.7B)

Constraints that may be associated with payload protrusions include:

- Removal of the protrusion during rack installation, translation, and crew translation
- Removal of the protrusion if RMA is installed on the rack
- Removal of the protrusion to prevent interference with microgravity operations
- Removal or powering off of the rack if the protrusion blocks Portable Fire Extinguisher (PFE) access or the fire indicator
- May limit the rack location (e.g., Protrusion located in the floor and the ceiling are limited to a total of no more than 12 inches.)
- May limit operation of the payload

As is indicated by the constraints above, protrusions have a negative impact on crew operations and are to be minimized.

3.2.2.2.2.1.1 On-Orbit Permanent Protrusions

Not Applicable to the FGI Flight Calibration Unit.

3.2.2.2.2.1.2 On-Orbit Semi-Permanent Protrusions

A. Not Applicable to the FGI Flight Calibration Unit.

B. Not Applicable to the FGI Flight Calibration Unit.

3.2.2.2.2.1.3 On-Orbit Temporary Protrusions

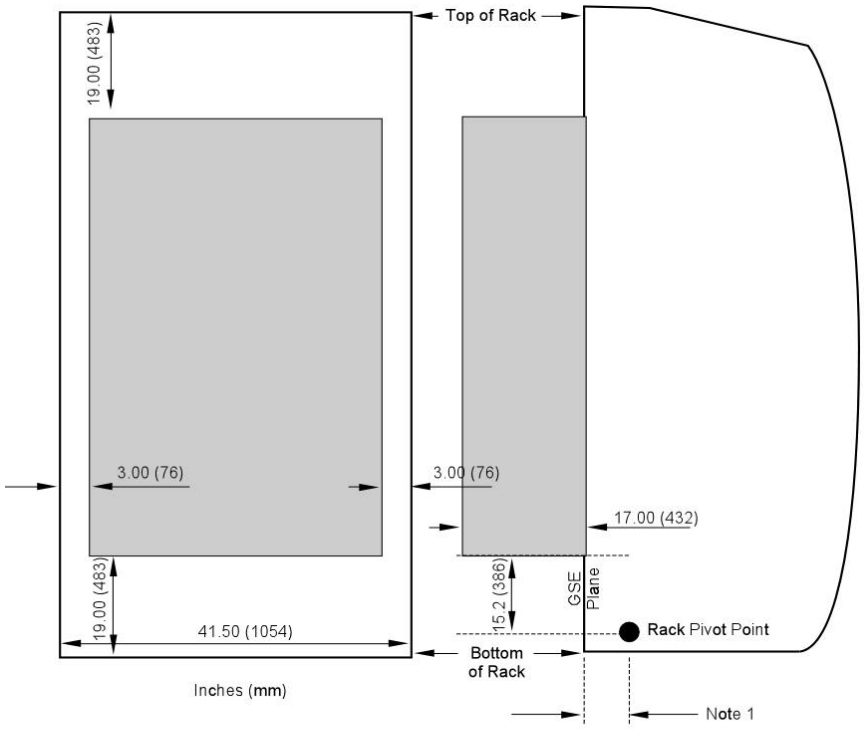
The FGI Flight Calibration Unit will take exception to requirement A below:

A. On-orbit temporary protrusions shall remain within the envelope shown in Figure 3.2.2.2.2.1.3-1. (SSP 57000, Section 3.1.1.7A)

B. The combination of all on-orbit temporary protrusions for the integrated rack shall be designed such that they can be eliminated or returned to their stowed configuration by the crew with hand operations and/or standard Intravehicular Activity (IVA) tools within 10 minutes. (SSP 57000, 3.1.1.7.3B)

NOTE: Integrated racks must provide stowage for on-orbit temporary protrusions with their stowage allocation.

NOTE: On-orbit temporary protrusions for payloads located in the floor or ceiling are limited to 6 inches beyond each or a total of 12 inches for both floor and ceiling.



Note:
1. The dimension for a Boeing ISPR is 3.50 (89). The dimension for a NASDA ISPR is 2.47 (63).
2. Protrusions are limited to 1.3 (33mm) inches for ground processing and launch/landing as described in paragraph 3.1.1.1.A
3. The A1 and F1 positions in the JEM can not accommodate temporary protrusions due to the interference with the Intermodule Ventilation (IMV) function.

Figure 3.2.2.2.2.1.3-1 On-Orbit Temporary Protrusions Envelope

3.2.2.2.2.1.4 On-Orbit Momentary Protrusions

Not applicable to the FGI Flight Calibration Unit.

3.2.2.2.2.1.5 Deleted.

3.2.2.2.2.2 Deployed Envelope Dimensions

The FGI Flight Calibration Unit method of deployment is discussed in Section 3.1.1.2.

3.2.3 Reliability, Quality, and Non-Conformance Reporting

A. Reliability and maintainability requirements for the FGI Flight Calibration Unit shall be as defined in LS-71026, "Human Research Facility (HRF) Reliability Plan." (LS-71000, Section 7.2)

B. Quality Assurance for the HRF Program shall be implemented in accordance with the LS-71030, "Quality Assurance Plan for the Human Research Facility." (LS-71000, Section 7.3.1)

C. Non-Conformance Reporting

1. For flight hardware produced under a contract or subcontract at a site other than JSC, non-conformance reporting requirements shall be specified in the Statement of Work (SOW) Data Requirements List, and Data Requirements Definitions (DRDs) shall be used to identify the submittal and data requirements. (LS-71000, Section 7.3.2.1)

2. For flight hardware developed at JSC, non-conformance reporting shall be in accordance with JPD 5335.1 and the applicable technical division plan. (LS-71000, Section 7.3.2.2)

3. Non-conformances, which meet the Level 1 Problem Reporting and Corrective Action criteria for payloads as defined in SSP 30223, shall be reported in accordance with SSP 30223. (LS-71000, Section 7.3.2.3)

4. Software non-conformance reporting shall be in accordance with LS-71020-1, "Software Development Plan for the Human Research Facility." (LS-71000, Section 7.3.2.4)

3.2.3.1 Failure Propagation

The design shall preclude propagation of failures from the payload to the environment outside the payload. (NSTS 1700.7B, Section 206)

3.2.3.2 Useful Life

FGI Flight Calibration Unit hardware shall be designed for a 10 year utilization. (LS-71000, Section 7.2.1)

3.2.3.2.1 Operational Life (Cycles)

Operational life applies to any hardware that deteriorates with the accumulation of operating time and/or cycles and thus requires periodic replacement or refurbishment to maintain acceptable operating characteristics. Operational life includes the usage during flight, ground testing, and pre-launch operations. All components of the FGI Flight Calibration Unit shall have an operational life limit of 10 years, except those identified as having limited life, see Section 3.2.3.2.3.

3.2.3.2.2 Shelf Life

Shelf life is defined as that period of time during which the components of a system can be stored under controlled conditions and put into service without replacement of parts (beyond servicing and installation of consumables). The FGI Flight Calibration Unit shall have a shelf life limit of To Be Determined (TBD).

3.2.3.2.3 Limited Life

Limited life is defined as the life of a component, subassembly, or assembly that expires prior to the stated useful life in Section 3.2.2.2.1. Limited life items or materials, such as soft goods, shall be identified, and the number of operational cycles shall be determined. Limited life items shall be tracked on a limited life list that is maintained as a part of the hardware acceptance data pack.

3.2.4 Maintainability

A-G. Deleted.

3.2.4.1 Logistics and Maintenance

3.2.4.1.1 Payload In-Flight Maintenance

Deleted.

3.2.4.1.2 Maintenance

The following activities shall be performed on the ground as part of scheduled maintenance for the FGI Flight Calibration Unit:

A. Verification of the relief valve function shall be performed every two years.

B. The neoprene bladder shall be replaced every two years.

C. The digital pressure gauge battery shall be replaced every two years.

D. A leak test shall be performed every two years following bladder replacement.

The FGI Flight Calibration Unit inflight cleanliness/maintenance shall be controlled through an on-orbit operations procedure. This section is not verifiable.
No on-orbit unscheduled maintenance activities shall be performed.

3.2.5 Environmental Conditions

3.2.5.1 On-Orbit Environmental Conditions

3.2.5.1.1 On-Orbit Internal Environments

3.2.5.1.1.1 Pressure

The FGI Flight Calibration Unit shall be safe when exposed to pressures of 0 to 104.8 kPa (0 to 15.2 psia). (LS-71000A, Section 6.3.6.1.1)

3.2.5.1.1.2 Temperature

The FGI Flight Calibration Unit shall be safe when exposed to temperatures of 10° to 46 °C (50 to 115 °F). (LS-71000A, Section 6.3.6.1.2)

3.2.5.1.1.3 Humidity

Not applicable to the FGI Flight Calibration Unit.

3.2.5.1.2 Use of Cabin Atmosphere

3.2.5.1.2.1 Active Air Exchange

Deleted.

3.2.5.1.2.2 Oxygen Consumption

Oxygen consumption is defined by ISS for integrated racks only. Maximum leakage rate must be documented in the FGI Flight Calibration Unit ICD. (LS-71000A, Section 6.3.6.2.2)

3.2.5.1.2.3 Chemical Releases

Chemical releases to the cabin air shall be in accordance with Paragraphs 209.1a and 209.1b in NSTS 1700.7, ISS Addendum. (LS-71000A, Section 6.3.6.2.3)

3.2.5.1.2.4 Cabin Air Heat Leak

Cabin air heat rejection is defined by the ISS program in terms of ISS modules only. No sub-allocation has been made for integrated racks or Experiment Unique Equipment (EUE). FGI Flight Calibration Unit maximum cabin air heat rejection must be documented in the FGI Flight Calibration Unit ICD. (LS-71000A, Section 6.3.4.2)

3.2.5.1.2.5 Cabin Air Cooling

Deleted.

3.2.5.1.3 Ionizing Radiation Requirements

3.2.5.1.3.1 Instrument Contained or Generated Ionizing Radiation

Deleted.

3.2.5.1.3.2 Ionizing Radiation Dose

The hardware should expect a total dose (including trapped protons and electrons) of 30 Rads (Si) per year of ionizing radiation. A review of the dose estimates in the ISS (SAIC-TN-9550) may show ionizing radiation exposure to be different than 30 Rads (Si) per year, if the intended location of the rack in the ISS is known. (LS-71000A, Section 6.3.6.3.2)

3.2.5.1.3.3 Single Event Effect (SEE) Ionizing Radiation

The FGI Flight Calibration Unit shall be designed not to produce an unsafe condition or one that could cause damage to equipment external to the FGI Flight Calibration Unit as a result of exposure to SEE ionizing radiation assuming exposure levels specified in SSP 30512, Paragraph 3.2.1, with a shielding thickness of 25.4 mm (1000 mils). (LS-71000A, Section 6.3.6.3.3)

3.2.5.1.4 Additional Environmental Conditions

The environmental information provided in Table 3.2.5.1.4-1, Environmental Conditions on ISS, and Figure 3.2.5.1.4-1, Operating Limits of the ISS Atmospheric Total Pressure, Nitrogen and Oxygen Partial Pressures, is for design and analysis purposes. (LS-71000A, Section 6.3.6.3.4)

TABLE 3.2.5.1.4-1. ENVIRONMENTAL CONDITIONS ON ISS

Environmental Condition	Value
Atmospheric Conditions	
Pressure Extremes	0 to 104.8 kPa (0 to 15.2 psia)
Normal operating pressure	See Figure 3.2.5.1.4-1
Oxygen partial pressure	See Figure 3.2.5.1.4-1
Nitrogen partial pressure	See Figure 3.2.5.1.4-1
Dewpoint	4.4 to 15.6 °C (40 to 60 °F)
Percent relative humidity	25 to 75
Carbon dioxide partial pressure during normal operations with 6 crewmembers plus animals	24-hr average exposure 5.3 mm Hg Peak exposure 7.6 mm Hg
Carbon dioxide partial pressure during crew changeout with 11 crewmembers plus animals	24-hr average exposure 7.6 mm Hg Peak exposure 10 mm Hg
Cabin air temperature in United States Lab (USL), Japanese Experiment Module (JEM), Attached Pressurized Module (APM), and Centrifuge Accommodation Module (CAM)	17 to 28 °C (63 to 82 °F)
Cabin air temperature in Node 1	17 to 31 °C (63 to 87 °F)
Air velocity	0.051 to 2.03 m/s (10 to 40 ft/min)
Airborne microbes	Less than 1000 Colony Forming Units (CFU)/m^3
Atmosphere particulate level	Average less than 100,000 particles/ft^3 for particles less than 0.5 microns in size
Mini Pressurized Logistics Module (MPLM) Air Temperatures	**Active and Passive Flights**
Extremes for all phases of flight	10 to 46 °C (50 to 114.8 °F)
Thermal Conditions	
Module wall temperature	13 °C to 43 °C (55 °F to 109 °F)
Other integrated payload racks	Front surface less than 37 °C (97 °F)
Microgravity	TBD
General Illumination	108 Lux (10 fc) measured 30 inches from the floor in the center of the aisle

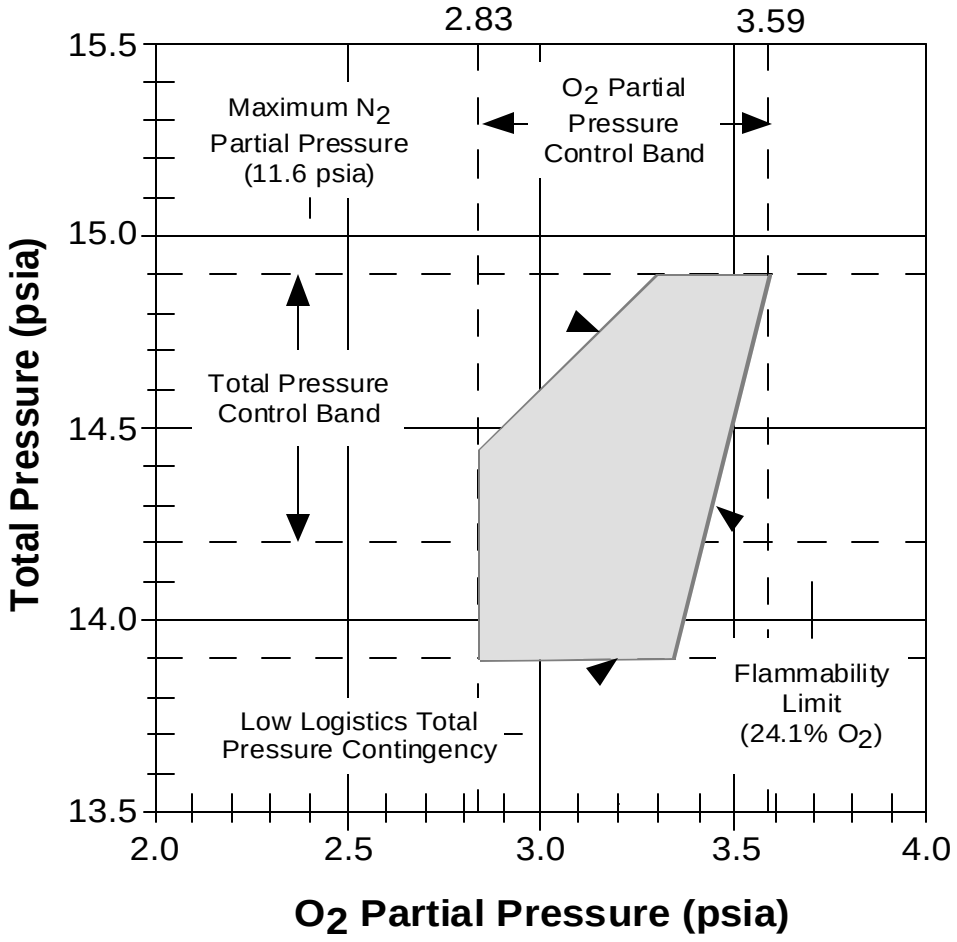


Figure 3.2.5.1.4-1. Operating Limits of the ISS Atmospheric Total Pressure, Nitrogen, and Oxygen Partial Pressures

3.2.5.1.5 Pressure Rate of Change

A. The FGI Flight Calibration Unit shall maintain positive margins of safety for the on-orbit depress/repress rates in Table 3.2.5.1.5-1. (LS-71000A, Section 6.3.1.2B)

TABLE 3.2.5.1.5-1. ISS PRESSURE RATE OF CHANGE

Depressurization	878 Pa/sec (7.64 psi/minute)
Repressurization	230 Pa/sec (2.0 psi/minute)

B. Deleted.

C. The hardware shall maintain positive margins of safety for maximum depressurization and repressurization rates for the carrier(s) in which it will be transported. (LS-71000A, Section 6.3.1.2A)

(1) The hardware shall maintain positive margins of safety for maximum depressurization and repressurization rates for the MPLM documented in Table 3.2.5.1.5-2. (Derived from LS-71000A, Section 6.3.1.2A)

TABLE 3.2.5.1.5-2. MPLM PRESSURE RATE OF CHANGE

Depressurization	878 Pa/sec (7.64 psi/minute)
Depressurization	878 Pa/sec (7.64 psi/minute)

(2) The hardware shall maintain positive margins of safety for maximum depressurization and repressurization rates for the Orbiter Middeck documented in Table 3.2.5.1.5-3.

TABLE 3.2.5.1.5-3. ORBITER MIDDECK PRESSURE RATE OF CHANGE

Depressurization/Represurization	1031 Pa/sec (9.0 psi/minute)

D. Deleted.

3.2.5.2 Acoustic Emission Limits

3.2.5.2.1 Continuous Noise Limits

The FGI Flight Calibration Unit continuous acoustical emissions shall individually comply with the acoustic requirements (NC-40 equivalent) in Table 3.2.5.2.1-1. (LS-71000A, Section 6.4.3.3.1C)

TABLE 3.2.5.2.1-1. CONTINUOUS NOISE LIMITS

Rack Noise Limits Measured at 0.6 Meters Distance From the Test Article	
Frequency Band (Hz)	Integrated Rack Sound Pressure Level (SPL)
63	64
125	56
250	50
500	45
1000	41
2000	39
4000	38
8000	37

3.2.5.2.2. Intermittent Noise Limits

Deleted.

3.2.5.3 Instrument Surface Temperature

Deleted.

3.2.6 Transportability

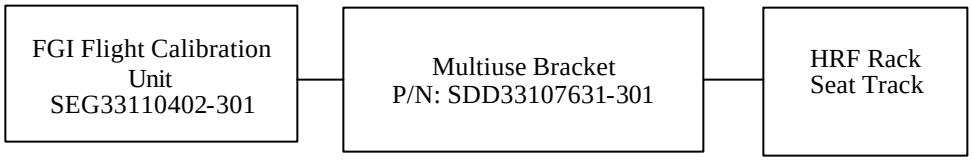
3.2.6.1 Launch and Landing

The FGI Flight Calibration Unit shall be transportable to and from orbit. Equipment carried in the Shuttle mid-deck lockers shall be transportable in the Shuttle mid-deck locker to and from orbit, as specified in NSTS-21000-IDD-MDK.

3.2.7 Operational Interface Requirements

3.2.7.1 Mechanical Interface Requirements

The FGI Flight Calibration Unit shall be stowed for launch and transport to the ISS. It requires no shuttle services or interfaces. The FGI Flight Calibration Unit shall interface with the HRF Rack seat track via a Multi-use Bracket (P/N: SEG33107631-301). The Flight Calibration Unit shall mount to the bracket using the Desk Top Plate Assembly Inflight Computer Mounting Shoe (P/N: SDD33108701).



3.2.7.1.1 Connector Physical Mate

Deleted.

3.2.7.2 Electrical Interface Requirements

The FGI Flight Calibration Unit shall have no electrical interfaces. A 9V battery shall power the hardware.

3.2.7.2.1 Electromagnetic Radiation

3.2.7.2.1.1 Electromagnetic Compatibility (EMC)

Deleted.

3.2.7.2.1.1.1 Electrical Grounding

Deleted.

3.2.7.2.1.1.2 Electrical Bonding

Deleted.

3.2.7.2.1.2 Electromagnetic Interference

A. The FGI Flight Calibration Unit shall meet all Electromagnetic Interference (EMI) requirements of SSP 30237. (LS-71000A, Section 6.3.2.4.4)

B. Alternately, the payload Electrical Power Consuming Equipment (EPCE) may choose to accept a minimal increase of EMI risk with a somewhat less stringent Electric Field Radiated Susceptibility (RS03) requirement on equipment considered to be non-safety critical to the vehicle and crew. The tailored RS03 requirement, shown below, will hereafter be denoted RS03PL. (LS-71000A, Section 6.3.2.4.4)

TABLE 3.2.7.2.1.2-1. RS03PL

FREQUENCY	RS03PL LIMIT (V/m)
14 kHz - 400 MHz	5
400 MHz - 450 MHz	30
450 MHz - 1 GHz	5
1 GHz - 5 GHz	25
5 GHz - 6 GHz	60
6 GHz - 10 GHz	20
13.7 GHz - 15.2 GHz	25

Comments: The less stringent RS03PL limit was developed to envelope the electric fields generated by ISS transmitters and ground-based radars tasked to perform space surveillance and tracking. Ground-based radars that are not tasked to track the ISS and search radars that could momentarily sweep over the ISS are not enveloped by the relaxed RS03PL. For most scientific payloads, the minimal increase of EMI risk for the reduced limits is acceptable. The RS03PL limit does not account for module electric field shielding effectiveness that could theoretically reduce the limits even more. Although shielding effectiveness exists, it is highly dependent on the EPCE location within the module with respect to ISS windows.

3.2.7.2.2 Electrostatic Discharge

A. Unpowered FGI Flight Calibration Unit EPCE shall not be damaged by Electrostatic Discharge (ESD) equal to or less than 4000 V to the case or any pin on external connectors. (LS-71000A, Section 6.3.2.5)

B. FGI Flight Calibration Unit EPCE that may be damaged by ESD between 4000 V and 15,000 V shall have a label affixed to the case in a location clearly visible in the installed position. (LS-71000A, Section 6.3.2.5)

C. Labeling of FGI Flight Calibration Unit EPCE susceptible to ESD up to 15,000 V shall be in accordance with MIL-STD-1686. (LS-71000A, Section 6.3.2.5)

NOTE: These voltages are the result of charges that may be accumulated and discharged from ground personnel or crewmembers during equipment installation or removal. (LS-71000, Section 6.3.2.5)

3.2.7.2.3 Corona

The FGI Flight Calibration Unit shall be designed to preclude damaging or destructive corona in its operating environment. Guidance for meeting the corona requirement is found in MSFC-STD-531, High Voltage Design Criteria. Per MIL-STD-531, corona is a luminous discharge due to the ionization of the gas surrounding a conductor around which exists a voltage gradient exceeding a certain critical value. (LS-71000, Section 6.3.2.8)

3.2.7.2.4 Cable/Wire Design and Control Requirements

Deleted.

3.2.7.2.5 Loss of Power

Deleted.

3.2.7.2.6 Alternating Current Magnetic Fields

The generated Alternating Current (AC) magnetic fields, measured at a distance of 7 centimeters (cm) from the generating equipment, shall not exceed 140 Decibels (dB) above 1 picotesla for frequencies ranging from 30 Hz to 2 KHz, then falling 40 dB per decade to 50 KHz. (LS-71000A, Section 6.3.2.6)

3.2.7.2.7 Direct Current Magnetic Fields

The generated Direct Current (DC) magnetic fields shall not exceed 170 dB picotesla at a distance of 7 cm from the generating equipment. This applies to electromagnetic and permanent magnetic devices. (LS-71000A, Section 6.3.2.7)

3.2.7.3 Command and Data Handling (C&DH) Interface Requirements

Deleted.

3.2.7.4 Fire Protection Interface Requirements

Fire detection requirements for instruments operated outside of rack volumes have not been defined by ISS. Fire detection methodology for instruments operated outside of rack volumes must be approved by the PSRP. Fire protection requirements in this section apply to all instruments. Fire suppression requirements in this section apply for instruments operated outside of the rack volume that have forced air flow. (LS-71000A, Section 6.3.7)

3.2.7.4.1 Fire Prevention

The FGI Flight Calibration Unit shall meet the fire prevention requirements specified in NSTS 1700.7B, ISS Addendum, Paragraph 220.10a. (LS-71000A, Section 6.3.7.1)

NOTE: Reference in SSP 57000C and LS-71000A to 220.10a is an error. The reference should be to 220.10.

3.2.7.4.2 Fire Suppression

Deleted.

3.2.7.4.3 Labeling

Deleted.

3.2.7.5 Other Interface Requirements

The FGI Flight Calibration Unit shall interface with the HRF Rack nitrogen supply.

3.2.7.5.1 Human Research Facility Rack Nitrogen Interface Connectors

Rack dependent instruments that connect to the HRF Rack nitrogen interface shall use a Quick Disconnect connector (P/N 683-16348-353 or equivalent). (LS-71000A, Section 6.2.7.1.1)

3.2.7.5.2 Nitrogen Interface Control

Rack dependent instruments shall provide a means, located within the instrument envelope, to turn on and off the flow of nitrogen from the integrated rack and to control the flow of nitrogen to not exceed 5.43 kg/hr (12 lb./hr) when connected to the nitrogen interface operating pressure range of 517 to 827 kPa (75 to 120 psia). (LS-71000A, Section 6.2.7.1.2)

3.2.7.5.3 Nitrogen Interface MDP

The Maximum Design Pressure (MDP) of the rack dependent instrument nitrogen system shall be 1,379 kPa (200 psia). (LS-71000A, Section 6.2.7.1.3)

3.2.7.5.4 Nitrogen Interface Temperature

Rack dependent instrument nitrogen systems shall be designed for a nitrogen supply temperature range of 15.6 °C to 45 °C (60 °F to 113 °F). (LS-71000A, Section 6.2.7.1.4)

3.2.7.5.5 Nitrogen Leakage

Nitrogen leakage is defined by ISS at the integrated rack level only. Instrument nitrogen leakage must be coordinated with HRF Systems Engineering and Integration (SE&I). (LS-71000A, Section 6.2.7.1.5)

3.3 DESIGN AND CONSTRUCTION

3.3.1 Materials, Processes, and Parts

3.3.1.1 Materials and Processes

A. The FGI Flight Calibration Unit shall use materials and parts that meet the materials requirements specified in NSTS 1700.7, ISS Addendum, Section 209. (LS-71000A, Section 6.3.8.1)

B. Commercial-Off-the-Shelf (COTS) parts used in the FGI Flight Calibration Unit shall meet the materials requirements specified in NSTS 1700.7, ISS Addendum, Section 209. (LS-71000A, Section 6.3.8.2)

C. The FGI Flight Calibration Unit shall conform to Visibly Clean-Sensitive (VC-S) requirements as specified in SN-C-0005. (LS-71000A, Section 6.3.8.3)

D. Deleted.

E. HRF instruments that are intended to remain on-orbit for more than one year shall use fungus resistant materials according to the requirements specified in SSP 30233, Paragraph 4.2.10. (LS-71000A, Section 6.3.8.4)

3.3.1.2 Sharp Edges and Corner Protection

The FGI Flight Calibration Unit design within a pressurized module shall protect crewmembers from sharp edges and corners during all crew operations in accordance with NSTS 1700.7, ISS Addendum, Paragraph 222.1. (LS-71000A, Section 6.4.9.2)

3.3.1.3 Holes

Holes that are round or slotted in the range of 10.0 to 25.0 mm (0.4 to 1.0 in) shall

be covered. (LS-71000A, Section 6.4.9.3)

3.3.1.4 Latches

Latches that pivot, retract, or flex so that a gap of less than 35 mm (1.4 in) exists shall be designed to prevent entrapment of a crewmember's appendage. (LS-71000A, Section 6.4.9.4)

3.3.1.5 Screws and Bolts

Threaded ends of screws and bolts accessible by the crew and extending more than 3.0 mm (0.12 in) shall be capped to protect against sharp threads. (LS-71000A, Section 6.4.9.5)

3.3.1.6 Securing Pins

Securing pins shall be designed to prevent their inadvertently backing out above the handhold surface. (LS-71000A, Section 6.4.9.6)

3.3.1.7 Levers, Cranks, Hooks, and Controls

Levers, cranks, hooks, and controls shall not be located where they can pinch, snag, or cut the crewmembers or their clothing. (LS-71000A, Section 6.4.9.7)

3.3.1.8 Burrs

Exposed surfaces shall be free of burrs. (LS-71000A, Section 6.4.9.8)

3.3.1.9 Locking Wires

Deleted.

3.3.2 Nameplates and Product Marking

3.3.2.1 Equipment Identification

Integrated racks, all (installed in the rack or separately) sub-rack elements, loose equipment, stowage trays, consumables, Orbital Replacement Units (ORUs), crew accessible connectors and cables, switches, indicators, and controls shall be labeled. Labels are markings of any form [including Inventory Management System (IMS) bar codes] such as decals and placards, which can be adhered, "silk screened," engraved, or otherwise applied directly onto the hardware. Appendix C of SSP 57000C provides instructions for label and decal design and approval. (LS-71000A, Section 6.4.7)

3.3.3 Workmanship

Workmanship shall be of aerospace quality and shall conform to high grade aerospace manufacturing practices as directed in LS-71030, "Quality Assurance

Plan for the Human Research Facility." (LS-71000, Section 7.3.1.)

3.3.4 Interchangeability

Interchangeability requirements are not applicable to detail parts of permanent assemblies such as welded assemblies or matched detailed parts such as lapped components. Interchangeability requirements do not apply to custom-fitted or custom-sized items.

All replaceable parts or assemblies having the same part number shall be directly and completely interchangeable with each other with respect to form, fit and function.

3.3.5 Safety Requirements

3.3.5.1 Electrical Safety

3.3.5.1.1 Mating/Demating of Powered Connectors

Deleted.

3.3.5.1.2 Power Switches/Controls

A. Not applicable to the FGI Flight Calibration Unit.

B. Not applicable to the FGI Flight Calibration Unit.

C. Not applicable to the FGI Flight Calibration Unit.

3.3.5.1.3 Ground Fault Circuit Interrupters/Portable Equipment DC Sourcing Voltage

A-G Deleted.

3.3.5.1.4 Portable Equipment/Power Cords

Deleted.

3.3.6 Human Engineering

3.3.6.1 Closures or Covers Design Requirements

Closures or covers shall be provided for any area of the payload that is not designed for routine cleaning. (LS-71000A, Section 6.4.3.1.1)

NOTE: As a goal, SSP 50005, Section 11.4.3 may be used as guidelines for the design of closures and covers on equipment housing.

3.3.6.2 Interior Color

3.3.6.2.1 Rack Mounted Equipment

Deleted.

3.3.6.2.2 Stowed/Deployable Equipment

The colors and finishes for stowed and deployable equipment, even if it is normally attached to the rack during use shall be as specified below:

A. COTS equipment that is not repackaged by HRF engineers shall be finished as delivered by the manufacturer. (LS-71000A, Section 6.4.3.5.2A)

B. Items that are repackaged by HRF engineers shall be finished using anodic film per MIL-A-8625, Type II, Class 2, Dyed Turquoise. Reference FED-STD-595, Color Specification 15187. (LS-71000A, Section 6.4.3.5.2B)

3.3.6.2.3 Colors for Soft Goods

Human factors engineering will provide guidance in the appropriate colors for soft goods in cooperation with the lead engineers, who will provide data on the available color choices for the specified materials. (LS-71000A, Section 6.4.3.5.3)

3.3.6.3 Full Size Range Accommodation

A. All payload workstations and hardware having crew nominal operations and planned maintenance shall be sized to meet the functional reach limits for the 5th percentile Japanese female and yet shall not constrict or confine the body envelope for the 95th percentile American male as specified in SSP 50005, Section 3. (LS-71000A, Section 6.4.2.3)

B. COTS equipment shall be as delivered by the manufacturer and is exempted from this requirement.

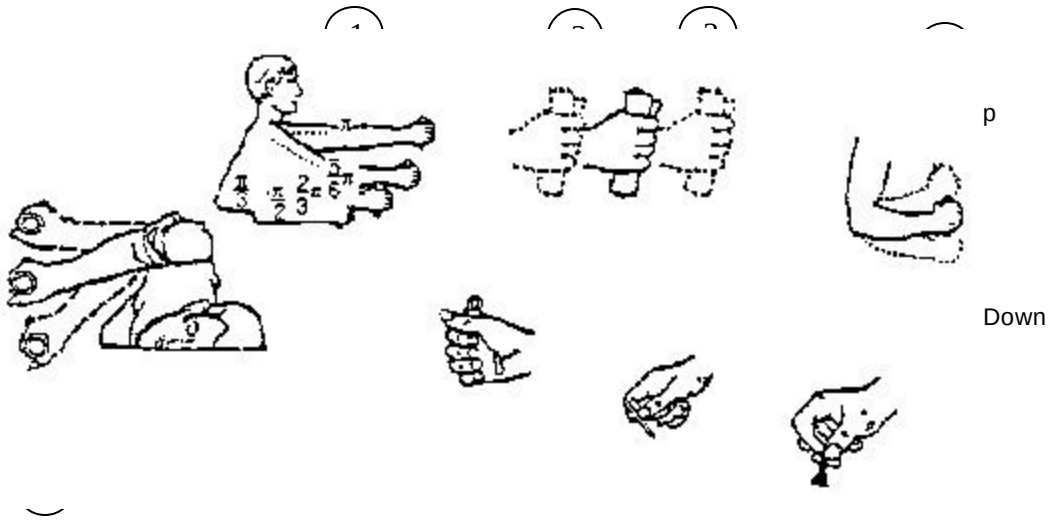
3.3.6.4 Operation and Control of Payload Equipment

A. Grip Strength

To remove, replace and operate payload hardware, grip strength required shall be less than 254 N (57 lbf). (LS-71000A, Section 6.4.1.1A)

B. Linear Forces

Linear forces required to operate or control payload hardware or equipment shall be less than the strength values for the 5th percentile female, defined as 50% of the strength values shown in Figure 3.3.6.4–1 and 60% of the strength values shown in Figure 3.3.6.4–2. (LS-71000A, Section 6.4.1.1B)



Arm Strength (N)												
(1)	(2)		(3)		(4)		(5)		(6)		(7)	
Degree of elbow flexion (rad)	Pull		Push		Up		Down		In		Out	
	L**	R**	L	R	L	R	L	R	L	R	L	R
p	222	231	187	222	40	62	58	76	58	89	36	62
5/6 p	187	249	133	187	67	80	80	89	67	89	36	67
2/3 p	151	187	116	160	76	107	93	116	89	98	45	67
1/2 p	142	165	98	160	76	89	93	116	71	80	45	71
1/3 p	116	107	96	151	67	89	80	89	76	89	53	76
Hand and thumb-finger strength (N)												
	(8)				(9)				(10)			
	Hand Grip											
	L		R		Thumb-finger grip (Palmer)				Thumb-finger grip (tips)			
Momentary hold	250		260		60				60			
Sustained hold	145		155		35				35			
*Elbow angle shown in radians **L = Left, R = Right												
Arm strength (lb)												
(1)	(2)		(3)		(4)		(5)		(6)		(7)	
Degree of elbow flexion (deg)	Pull		Push		Up		Down		In		Out	
	L	R*	L	R	L	R	L	R	L	R	L	R
180	50	52	42	50	9	14	13	17	13	20	8	14
150	42	56	30	42	15	18	18	20	15	20	8	15
120	34	42	26	36	17	24	21	26	20	22	10	15
90	32	37	22	36	17	20	21	26	16	18	10	16
60	26	24	22	34	15	20	18	20	17	20	12	17
Hand and thumb-finger strength (lb)												
	(8)				(9)				(10)			
	Hand Grip											
	L		R		Thumb-finger grip (Palmer)				Thumb-finger grip (tips)			
Momentary hold	56		59		13				13			
Sustained hold	33		35		8				8			
*Left; R = Right												

Figure 3.3.6.4-1. Arm, Hand, and Thumb/Finger Strength (5th Percentile Male Data)

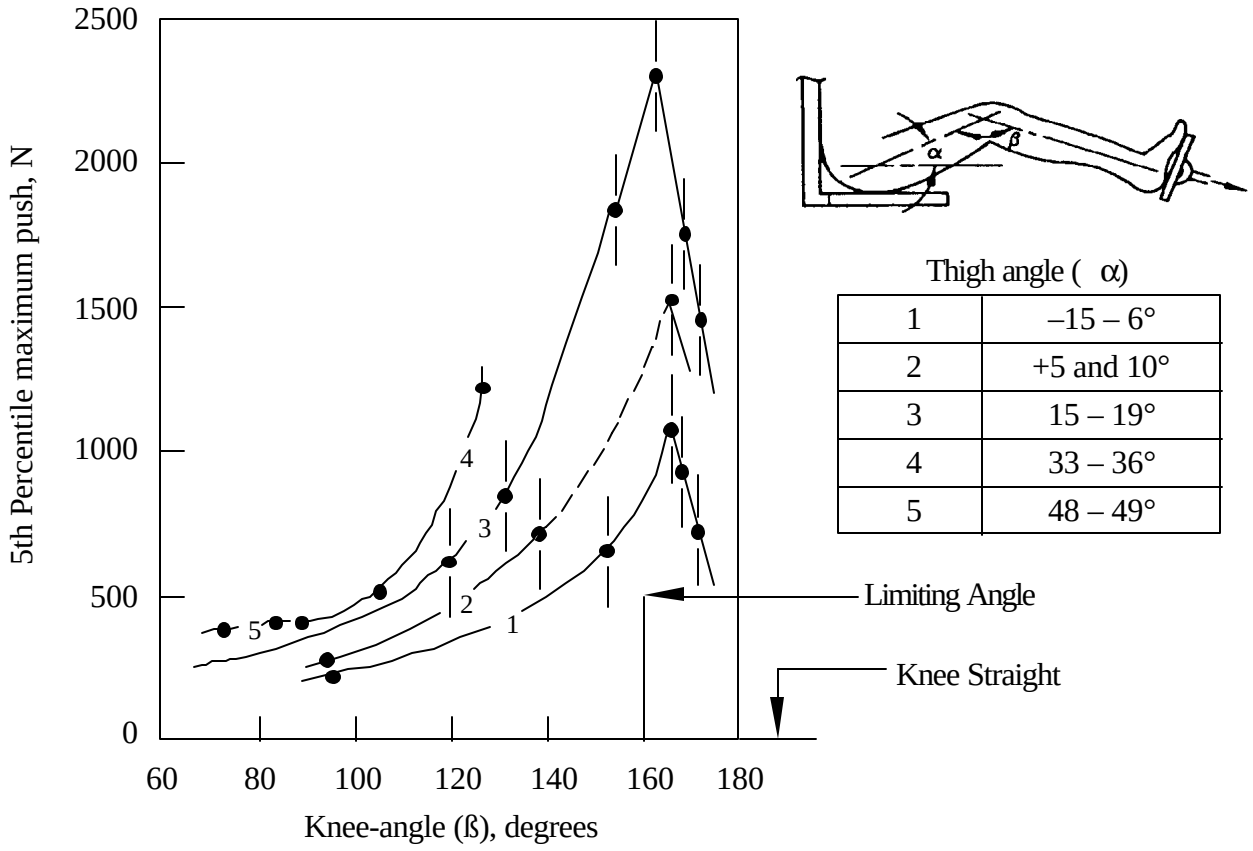


Figure 3.3.6.4-2. Leg Strength at Various Knee and Thigh Angles (5th Percentile Male Data)

C. Torque

Torque required to operate or control payload hardware or equipment shall be less than the strength values for the 5th percentile female, defined as 60% of the calculated 5th percentile male capability shown in Figure 3.3.6.4–3. (LS-71000A, Section 6.4.1.1C)

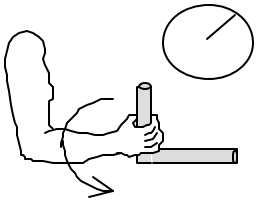
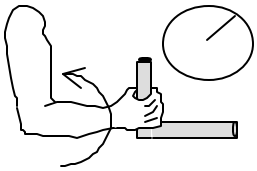
	Unpressurized suit, bare handed	
	Mean	SD
 Maximum torque: Suppination, Nm (lb.-in.)	13.73 (121.5)	3.41 (30.1)
 Maximum torque: Pronation, Nm (lb.-in.)	17.39 (153.9)	5.08 (45.0)

Figure 3.3.6.4-3. Torque Strength

3.3.6.5 Maintenance Operations

Deleted.

3.3.6.6 Adequate Clearance

Deleted.

3.3.6.7 Accessibility

A. Payload hardware shall be geometrically arranged to provide physical and visual access for all payload installation, operations, and maintenance tasks. Payload ORUs should be removable along a straight path until they have cleared the surrounding structure. (LS-71000, Section 6.4.2.2A)

B. IVA clearances for finger access shall be provided as given in Figure 3.3.6.7–1. (LS-71000A, Section 6.4.2.2B)

Minimal finger-access to first joint			
Push button access:	Bare hand: Thermal gloved hand:	32 mm dia (1.26 in.) 38 mm dia (1.5 in.)	
Two finger twist access:	Bare hand: Thermal gloved hand:	object plus 50 mm (1.97 in.) object plus 65 mm (2.56 in.)	

Figure 3.3.6.7–1. Minimum Sizes for Access Openings for Fingers

3.3.6.8 One-Handed Operation

Deleted.

3.3.6.9 Continuous/Incidental Contact - High Temperature

When payload surfaces whose temperature exceeds 49 °C (120 °F), which are subject to continuous or incidental contact, are exposed to crewmember's bare skin contact, protective equipment shall be provided to the crew, and warning labels shall be provided at the surface site. This also applies to surfaces not normally exposed to the cabin in accordance with the NASA IVA Touch Temperature Safety interpretation letter JSC MA2–95–048. (LS-71000A, Section 6.4.3.2.1)

3.3.6.10 Continuous/Incidental Contact – Low Temperature

Deleted.

3.3.6.11 Equipment Mounting

Equipment items used during nominal operations and planned maintenance shall be designed, labeled, or marked to protect against improper installation. (LS-71000A, Section 6.4.4.2.1)

3.3.6.12 Drawers and Hinged Panels

A. Deleted.

B. Deleted.

3.3.6.13 Alignment

Deleted.

3.3.6.14 Push-Pull Force

Payload hardware mounted into a capture-type receptacle that requires a push-pull action shall require a force less than 156 N (35 lbf) to install or remove. (LS-

71000, Section 6.4.4.2.5)

3.3.6.15 Covers

Where physical access is required, one of the following practices shall be followed, with the order of preferences given.

A. Provide a sliding or hinged cap or door where debris, moisture, or other foreign materials might otherwise create a problem. (LS-71000, Section 6.4.4.2.6.1A)

B. Provide a quick-opening cover plate if a cap will not meet stress requirements. (LS-71000, Section 6.4.4.2.6.1B)

3.3.6.16 Self-Supporting Covers

Deleted.

3.3.6.17 Accessibility

It shall be possible to mate/demate individual connectors without having to remove or mate/demate other connectors during nominal operations. (LS-71000A, Section 6.4.4.3.2A)

3.3.6.18 Ease of Disconnect

Deleted.

3.3.6.19 Self Locking

Deleted.

3.3.6.20 Connector Arrangement

A. Space between connectors and adjacent obstructions shall be a minimum of 25 mm (1 inch) for IVA access. (LS-71000A, Section 6.4.4.3.6A)

B. Deleted.

3.3.6.21 Arc Containment

Deleted.

3.3.6.22 Connector Protection

Protection shall be provided for all demated connectors against physical damage and contamination. (LS-71000A, Section 6.4.4.3.8)

3.3.6.23 Connector Shape

Deleted.

3.3.6.24 Alignment Marks or Guide Pins

Mating parts shall have alignment marks in a visible location during mating or guide pins (or their equivalent). (LS-71000A, Section 6.4.4.3.11A)

3.3.6.25 Coding

A. Both halves of mating connectors shall display a code or identifier, which is unique to that connection. (LS-71000A, Section 6.4.4.3.12A)

B. The labels or codes on connectors shall be located so they are visible when connected or disconnected. (LS-71000A, Section 6.4.4.3.12B)

3.3.6.26 Pin Identification

Deleted.

3.3.6.27 Orientation

Deleted.

3.3.6.28 Hose/Cable Restraints

A.-D. Deleted.

3.3.6.29 Non-Threaded Fasteners Status Indication

Deleted.

3.3.6.30 Mounting Bolt/Fastener Spacing

Deleted.

3.3.6.31 Multiple Fasteners

When several fasteners are used on one item they shall be of identical type. (LS-71000, Section 6.4.4.4.3)

NOTE: Phillips or Torque-Set fasteners may be used where fastener installation is permanent relative to planned on-orbit operations or maintenance, or where tool-fastener interface failure can be corrected by replacement of the unit containing the affected fastener with a spare unit.

3.3.6.32 Captive Fasteners

Deleted.

3.3.6.33 Quick Release Fasteners

A.-B. Deleted.

3.3.6.34 Threaded Fasteners

Deleted.

3.3.6.35 Over Center Latches

A.-C. Deleted.

3.3.6.36 Winghead Fasteners

Deleted.

3.3.6.37 Fastener Head Type

A. Deleted.

B. If a smooth surface is required, flush or oval head internal hex grip fasteners shall be used for fastening. (LS-71000, Section 6.4.4.4.9B)

C. Not applicable to the FGI Flight Calibration Unit.

3.3.6.38 One-Handed Actuation

Deleted.

3.3.6.39 Accessibility

Deleted.

3.3.6.40 Access Holes

Deleted.

3.3.6.41 Controls Spacing Design Requirements

All spacing between controls and adjacent obstructions shall meet the minimum requirements as shown in Figure 3.3.6.41-1, Control Spacing Requirements for Ungloved Operation. (LS-71000A, Section 6.4.4.5.1)

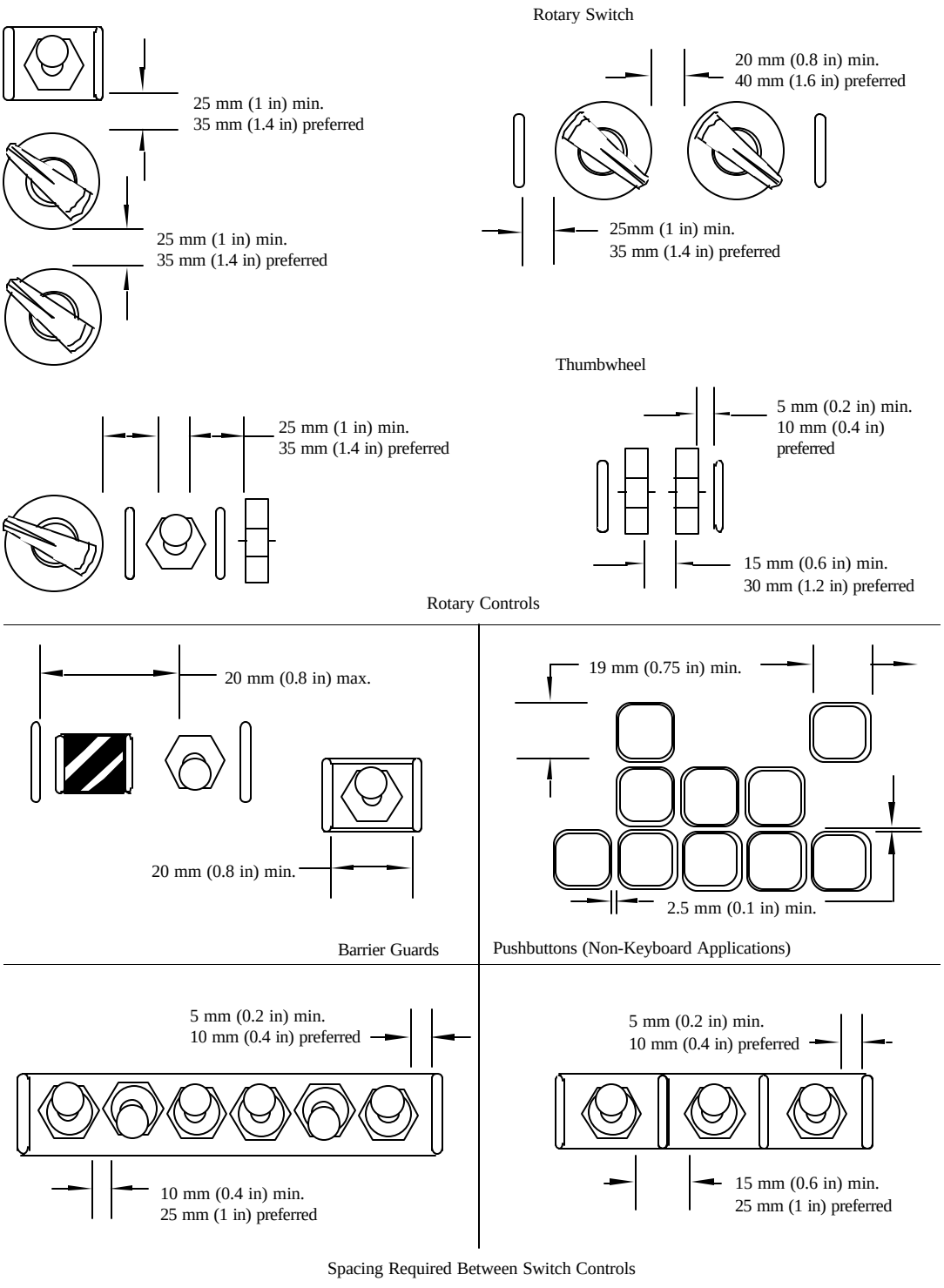


Figure 3.3.6.41-1. Control Spacing Requirements for Ungloved Operation

NOTE: Displays and controls used only for maintenance and adjustments which could disrupt normal operations if activated, should be protected during normal operations, e.g., by being located separately or guarded/covered.

3.3.6.42 Protective Methods

Payloads shall provide protection against accidental control actuation using one or more of the protective methods listed in sub–paragraphs A through G below. Infrequently used controls (i.e., those used for calibration) should be separated from frequently used controls. Leverlock switches or switch covers are strongly recommended for switches related to mission success. Switch guards may not be sufficient to prevent accidental actuation.

A. Locate and orient the controls so that the operator is not likely to strike or move them accidentally in the normal sequence of control movements. (LS-71000A, Section 6.4.5.2.1A)

B. Recess, shield, or otherwise surround the controls by physical barriers. The control shall be entirely contained within the envelope described by the recess or barrier. (LS-71000A, Section 6.4.5.2.1B)

C. Cover or guard the controls. Safety or lock wire shall not be used. (LS-71000A, Section 6.4.5.2.1C)

D. Cover guards when open shall not cover or obscure the protected control or adjacent controls. (LS-71000A, Section 6.4.5.2.1D)

E. Provide the controls with interlocks so that extra movement (e.g., lifting switch out of a locked detent position) or the prior operation of a related or locking control is required. (LS-71000A, Section 6.4.5.2.1E)

F. Provide the controls with resistance (i.e., viscous or coulomb friction, spring-loading, or inertia) so that definite or sustained effort is required for actuation. (LS-71000A, Section 6.4.5.2.1F)

G. Provide the controls with a lock to prevent the control from passing through a position without delay when strict sequential actuation is necessary (i.e., the control moved only to the next position, then delayed). (LS-71000A, Section 6.4.5.2.1G)

3.3.6.43 Noninterference

Payload provided protective devices shall not cover or obscure other displays or controls. (LS-71000A, Section 6.4.5.2.2)

3.3.6.44 Dead-Man Controls

Deleted.

3.3.6.45 Barrier Guards

Deleted.

3.3.6.46 Recessed Switch Protection

Deleted.

3.3.6.47 Position Indication

Deleted.

3.3.6.48 Hidden Controls

Deleted.

3.3.6.49 Hand Controllers

Deleted.

3.3.6.50 Valve Controls

Requirements for design of payload valve controls are defined as follows:

A. Low-Torque Valves – Valves requiring 1 N–m (10 in–lb) or less for operation are classified as "low-torque" valves and shall be provided with a "central pivot" type handle, 5.5 cm (2.25 in) or less in diameter. (see 3.3.6.50 D) (LS-71000A, Section 6.4.5.3A)

B. Intermediate-Torque Valves – Valves requiring between 1 and 2 N–m (10 and 20 in–lb) for operation are classified as "intermediate torque" valves and shall be provided with a "central pivot" type handle, 5.5 cm (2.25 in) or greater in diameter, or a "lever (end pivot) type" handle, 7.5 cm (3 in) or greater in length. (LS-71000A, Section 6.4.5.3B)

C. High-Torque Valves – Valves requiring 2 N–m (20 in–lb) or more for operation are classified as "high-torque" valves and shall be provided "lever type" handles greater than 7.5 cm (3 in) or greater in length. (LS-71000A, Section 6.4.5.3C)

D. Handle Dimensions – Valve handles shall adhere to the clearances and dimensions illustrated in Figures 3.3.6.50–1, Valve Handle-Central Pivot Type and 3.3.6.50–2, Valve Handle-Lever Type. (LS-71000A, Section 6.4.5.3D)

E. Rotary Valve Controls – Rotary valve controls shall open the valve with a counter-clockwise motion. (LS-71000A, Section 6.4.5.3E)

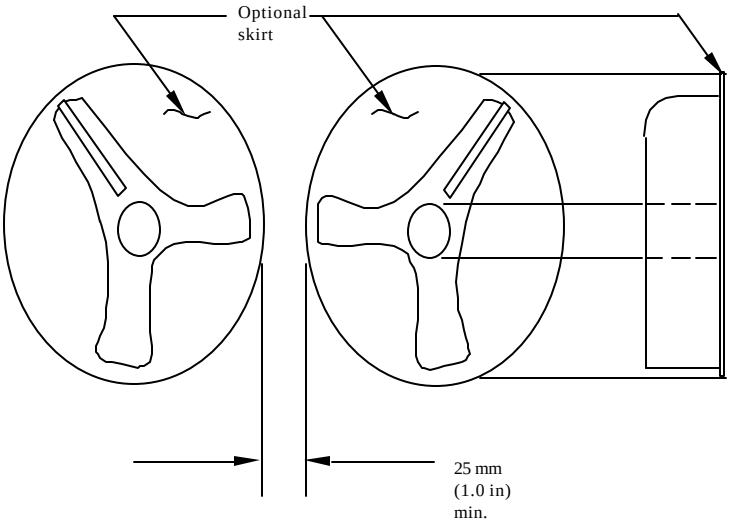


Figure 3.3.6.50–1. Valve Handle - Central Pivot Type

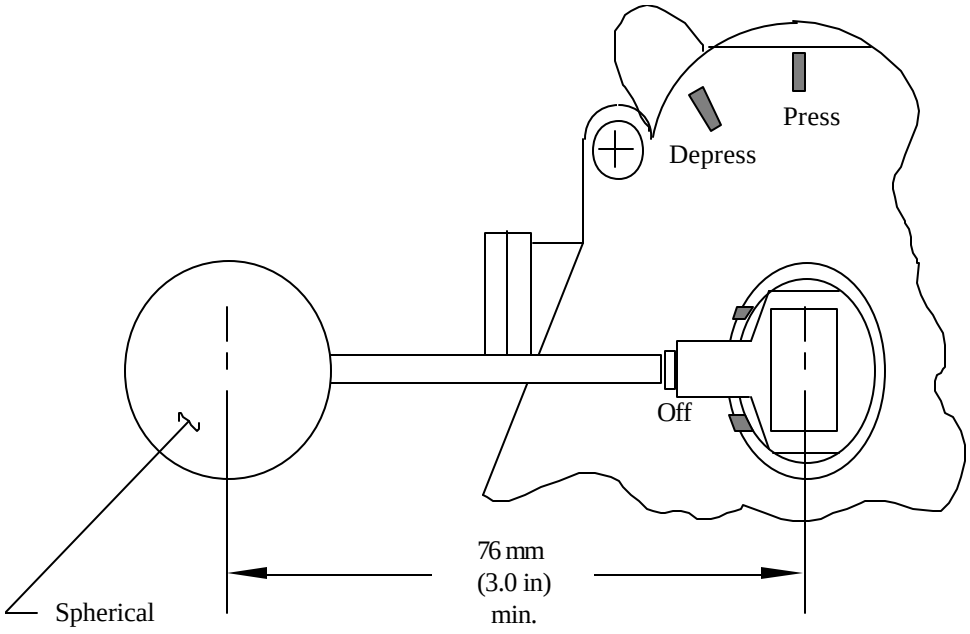


Figure 3.3.6.50–2. Valve Handle – Lever Type

3.3.6.51 Toggle Switches

Deleted.

3.3.6.52 Stowage Drawer Contents Restraints

Deleted.

3.3.6.53 Deleted.

3.3.6.54 Captive Parts

Payloads and payload equipment shall be designed in such a manner to ensure that all unrestrained parts (e.g., locking pins, knobs, handles, lens covers, access plates, or similar devices) that may be temporarily removed on-orbit will be tethered or otherwise held captive. (SSP 57000, 3.12.6.3)

3.3.6.55 Handles and Restraints

Deleted.

3.3.6.56 Handle Location/Front Access

Deleted.

3.3.6.57 Handle Dimensions

Deleted.

3.3.6.58 Non-Fixed Handles Design Requirements

A.-C. Deleted.

3.3.6.59 Electrical Hazards

A.-E. Deleted.

3.3.6.60 Mismatched

A.-D. Deleted.

3.3.6.61 Device Accessibility

Deleted.

3.3.6.62 Extractor –Type Fuse Holder

Deleted.

3.3.6.63 Overload Protection Location

Deleted.

3.3.6.64 Overload Protection Identification

Deleted.

3.3.6.65 Automatic Restart Protection

Deleted.

3.3.6.66 Audio Devices (Displays)

A.-C. Deleted.

3.3.6.67 Egress

All payload egress requirements shall be in accordance with NSTS 1700.7B, ISS Addendum, Paragraph 205. (LS-71000A, Section 6.4.9.11)

3.3.6.68 Fluid and Gas Line Connectors

Fluid and gas connectors that are mated and demated on-orbit shall be located and configured so that they can be fully inspected for leakage. (SSP 57000, 3.12.4.3.10).

3.3.6.69 Restraints and Mobility Aids

The FGI Flight Calibration Unit hardware shall be designed such that all installation, operation and maintenance can be performed using standard crew restraints, mobility aids, and interfaces as defined in SSP 30257:004. (SSP 57000, 3.12.6).

3.3.7 System Security

Not Applicable to FGI Flight Calibration Unit.

3.3.8 Design Requirements

3.3.8.1 Structural Design Requirements

A. The hardware shall maintain positive margins of safety for launch and landing loading conditions for the carrier(s) in which it will be transported:

   (1) Deleted.

   (2) Orbiter Middeck Launch and Landing Loading – TBD. (LS-71000A, Section 6.3.1.3A)

B. The hardware shall provide positive margins of safety for on-orbit loads of 0.2 Gs acting in any direction. (LS-71000A, Section 6.3.1.3B)

C. The hardware shall maintain positive margins of safety for MPLM depress rates

of 890 Pa/second (7.75 psi/minute) and repress rates of 800 Pa/second (6.96 psi/minute). (SSP 57000, Section 3.1.1.2.B)

3.3.8.1.1 Crew Induced Load Requirements

The hardware shall provide positive margins of safety when exposed to the crew induced loads defined in Table 3.3.8.1.1-1, Crew-Induced Loads. (LS-71000A, Section 6.3.1.3C)

3.3.8.1.2 Safety Critical Structures Requirements

Deleted.

TABLE 3.3.8.1.1-1. CREW-INDUCED LOADS

Crew System or Structure	Type of Load	Load	Direction of Load
Levers, Handles, Operating Wheels, Controls	Push or Pull concentrated on most extreme edge	222.6 N (50 lbf), limit	Any direction
Small Knobs	Twist (torsion)	14.9 N-M (11 ft-lbf), limit	Either direction
Exposed Utility Lines (Gas, Fluid, and Vacuum)	Push or Pull	222.6 N (50 lbf), limit	Any direction
Cabinets and any normally exposed equipment	Load distributed over a 4 inch by 4 inch area	556.4 N (125 lbf), limit	Any direction
Legend: ft = feet, m = meter, N = Newton, lbf = pounds force			

3.3.8.2 Electrical Power Consuming Equipment Design

3.3.8.2.1 Batteries

All battery systems shall meet the requirements of NSTS 1700.7, ISS addendum, Section 213.2. (Derived from LS-71000A, Section 6.3.2.10)

3.3.8.3 Pressurized Gas Bottle Design

3.3.8.3.1 Pressurized Gas Bottles

Not applicable to the FGI Flight Calibration Unit.

3.3.8.3.2 Manual Valves

If a manual valve is employed for control of a pressurized gas, the valve shall be accessible as specified in paragraph 3.3..6.50 without rack rotation. (LS-71000, Section 6.2.7.3)

3.4 ACCEPTANCE AND QUALIFICATION REQUIREMENTS

3.4.1 Nominal Operation Under Thermal Environment

The FGI Flight Calibration Unit shall operate nominally under the thermal environment described in 3.2.5.1.1.2.

3.4.2 Workmanship Vibration

The FGI Flight Calibration Unit shall operate nominally following vibration at workmanship loads.

3.4.3 Functional Performance

The FGI Flight Calibration Unit shall operate nominally under all planned modes of operation.

3.4.4 Electrical, Electronic, and Electromechanical Parts Control, Selection, and Burn-In

A. Parts control shall be in accordance with:

(1) NHB 5300.4(1F), "Electrical, Electronic, and Electromechanical (EEE) Parts Management and Control Requirements for NASA Space Flight Programs."

(2) SSP 30312, "Electrical, Electronic, and Electromechanical (EEE) and Mechanical Parts Management and Implementation Plan for Space Station Program."

B. Parts selection for equipment shall be in accordance with:

(1) SSP 30423, "Space Station Approved Electrical, Electronic, and Electromechanical (EEE) Parts List."

(2) SSQ-25002, "Supplemental List of Qualified Electrical, Electronic, Electromechanical (EEE) Parts, Manufacturers, and Laboratories (QEPM&L)."

(3) Semiconductors shall be JANTXV in accordance with MIL-S-19500, "General Specifications for Semiconductor Devices." Diodes shall have a metallurgical bond. Passive parts shall be at least the second highest level of appropriate Military Established Reliability (MIL-ER).

(4) SSP 30512C, "Space Station Ionizing Radiation Design Environment."

Where no alternative is available, nonmilitary parts, components, and subassemblies may be used, but burn-in screening of these items shall be performed per 3.4.4.C.

C. Burn-in screening shall be completed (100%) on all flight hardware (units).

3.4.5 Flammability

The FGI Flight Calibration Unit shall meet the flammability test requirements as described in 4.3.5.

3.4.6 Offgassing

The FGI Flight Calibration Unit located in inhabitable areas shall meet the offgassing test requirements as described in 4.3.6.

3.4.7 Bench Handling

The FGI Flight Calibration Unit shall meet the requirements as described in 4.3.7.

3.4.8 Payload Mass

The FGI Flight Calibration Unit shall meet the payload mass control requirements as described in 4.3.8.

3.4.9 Electromagnetic Compatibility

The FGI Flight Calibration Unit shall meet the EMC control requirements as described in 4.3.9.

3.4.10 Acoustic Noise

The FGI Flight Calibration Unit shall meet the acoustic noise control requirements as described in 4.3.10.

3.4.11 Pre-Delivery Acceptance

The FGI Flight Calibration Unit shall meet the pre-delivery acceptance (PDA) requirements as described in 4.3.11.

3.5 HUMAN RESEARCH FACILITY PROGRAM REQUIREMENTS

3.5.1 Safety

The FGI Flight Calibration Unit shall meet the applicable requirements of NSTS 1700.7, NSTS 1700.7 ISS Addendum, NSTS/ISS 18798, NSTS/ISS 13830, and KHB 1700.7.

3.5.2 Experiment Document

Deleted.

3.5.3 Documentation Requirements

Documentation requirements for FGI Flight Calibration Unit shall be as specified in Appendix A of the Preliminary Requirements Document (PRD) for HRF, LS-71000A. Required items for submittal to NASA are summarized below for convenience.

3.5.3.1 Acceptance Data Package Requirements List

The contents of the Acceptance Data Package (ADP) shall be based upon SSP 30695, Acceptance Data Package Requirements Specification, but shall also include the following:

#	Document	Required for Project		Comments
		Yes	No	
1	Engineering Drawings	√		
2	Inventory of Serialized Components		√	The FGI FCU has no field replaceable components.
3	Operating, Maintenance, and Handling Procedures	√		
4	"As run" Test Procedures, Data, and Reports	√		
5	Safety Data	√		
6	Structural Analyses	√		
7	Radioactive Material Data		√	The FGI FCU contains no radioactive material.
8	Calibration Data	√		

(1) Engineering Drawings: As-built engineering drawings shall be provided. The drawings shall include the top assembly drawing for each major component and any other drawings necessary to perform receiving inspection and any test or operation to be performed at the destination.

(2) Inventory of Serialized Components: A list of "field replaceable" serialized components will be included in the ADP. The list will contain the component part number, component name, and component serial number.

(3) Operating, Maintenance, and Handling Procedures: Each delivered functional end item shall have a separate manual covering its maintenance, repair, and operation. The manual shall include, but not be limited to, the following (as applicable):

a. Operational instructions suitable to support operator training and containing a system description and general instructions for operating the equipment.

b. Any special handling, packing, transportation or storage procedures (i.e., must be stored/transported in a specific orientation, specific environmental conditions, etc.).

c. A list of special tools, support and facilities equipment, and all other materials necessary to perform maintenance.

d. A schedule chart listing the time at which all maintenance is to be performed. This shall also include inspection for required repair, maintenance, or replacement of parts.

e. Conditions of environment in which maintenance is to be performed.

f. Detailed maintenance procedures that describe removal, disassembly, type of maintenance or repair, cleaning, reassemble, and reinstallation of all parts or subassemblies. Also included shall be points of inspection and notes of caution.

g. Illustrated part breakdowns showing the details of the part being worked upon.

h. Schematic and interconnecting wiring diagrams in sufficient detail to enable troubleshooting to be performed down to the replaceable subassembly or printed circuit board level.

i. Fault analysis will be provided to facilitate maintenance. The repair procedures shall be adequate for testing, checkout, disassembly, cleaning, inspection, repair, reassemble, adjustment, calibration, and servicing of the equipment as applicable.

(4) "As Run" Test Procedures and Reports: The original "as run" test procedures used for any of the testing required in this System Requirements Document (SRD), along with any associated data and test reports shall be included in the ADP. These procedures shall include quality buy-off if applicable as documented in the Quality Plan.

(5) Safety Data: Copies of hazard reports (HRs) and other safety data prepared or collected as a result of ground and/or flight safety requirements.

(6) Structural Analyses: Copies of any structural analyses performed as specified in this SRD or required in the contract with NASA.

(7) Radioactive Material Data: If the shipment contains any radioactive material, this section shall include copies of all required data on radioactive material.

(8) Calibration Data: This section shall include any calibration or scaling data required to interpret the output signals from or measurements made using the equipment being shipped.

3.5.3.1.1 ADP Statement in SOW

The SOW for procured flight items shall contain a DRD specifying the about ADP contents.

4.0 VERIFICATION PROVISIONS

This section contains the required verification methods for ISS interface certification, science functional acceptance, and program qualification and acceptance. Section 4.1 addresses definitions for terms used herein.

Appendix B contains the applicability matrix for ISS Pressurized Payload Interface Requirements Document requirements. The Verification Data Sheet (VDS) addressing the appropriate method for ISS interface verification is also contained in Appendix B. If an alternate verification method is desired, the new verification method must be negotiated in the Unique Payload Verification Plan.

Section 4.2 contains the verification methods for science functional acceptance. Appendix C contains the applicability matrix for science functional requirements.

Section 4.3 contains the verification methods for program qualification and acceptance requirements. Appendix D contains the applicability matrices for acceptance and qualification requirements.

The responsibility for the performance of all verification activities is as specified in Appendices B, C, and D. All testing described in Appendices B, C, and D shall be documented via Task Performance Sheet (TPS) (JSC Form 1225) per JSC Work Instruction NT1-CWI-001. Except as otherwise specified in the contract, the provider may use their own or any other facility suitable for the performance of the verification requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the verifications set forth in this specification.

4.1 GENERAL

Equipment verification methods are defined as follows:

A. Inspection is a method that determines conformance to requirements by the review of drawings, data or by visual examination of the item using standard quality control methods, without the use of special laboratory procedures.

B. Analysis is a process used in lieu of, or in addition to, other methods to ensure compliance to specification requirements. The selected techniques may include, but not be limited to, engineering analysis, statistics and qualitative analysis, computer and hardware simulations, and analog modeling. Analysis may also include assessing the results of lower level qualification activity. Analysis may be used when it can be determined that (1) rigorous and accurate analysis is possible, (2) test is not cost effective, and (3) verification by inspection is not adequate.

C. Verification by similarity is the process of analyzing the specification criteria for hardware configuration and application for an article to determine if it is similar or identical in design, manufacturing process, and quality control to an

existing article that has previously been qualified to equivalent or more stringent specification criteria. Special effort will be made to avoid duplication of previous tests from this or similar programs. If the previous application is considered to be similar, but not equal to or greater in severity, additional qualification tests shall concentrate on the areas of new or increased requirements.

D. Demonstration consists of a qualitative determination of the properties of a test article. This qualitative determination is made through observation, with or without special test equipment or instrumentation, which verifies characteristics such as human engineering features, services, access features, and transportability. Demonstration requirements are normally implemented within a test plan, operations plan, or test procedure.

E. Test is a method in which technical means, such as the use of special equipment, instrumentation, simulation techniques, and the application of established principles and procedures, are used for the evaluation of components, subsystems, and systems to determine compliance with requirements. Test shall be selected as the primary method when analytical techniques do not produce adequate results; failure modes exist which could compromise personnel safety, adversely affect flight systems or payload operation, or result in a loss of mission objectives; or for any components directly associated with Space Station and orbiter interfaces. The analysis of data derived from tests is an integral part of the test program, and should not be confused with analysis as defined above.

4.2 FUNCTIONAL PERFORMANCE ACCEPTANCE TESTING

The requirements herein describe specific test requirements for functional performance acceptance. The Principal Investigator (PI) will evaluate the data resulting from the science-related functional perfo rmance acceptance tests for confirmation of proper functionality.

The FGI Flight Calibration Unit functional performance characteristics specified in Section 3.2.1.1, A-E, shall be verified by a combination of inspection of the engineering drawings and inspection and demonstration of the hardware.

4.3 ACCEPTANCE AND QUALIFICATION VERIFICATION METHODS

The requirements herein describe specific test requirements for FGI Flight Calibration Unit acceptance and qualification. Qualification testing shall only be performed if qualification articles exist for the hardware. If no qualification articles exist for the hardware, analysis shall be used to qualify the hardware.

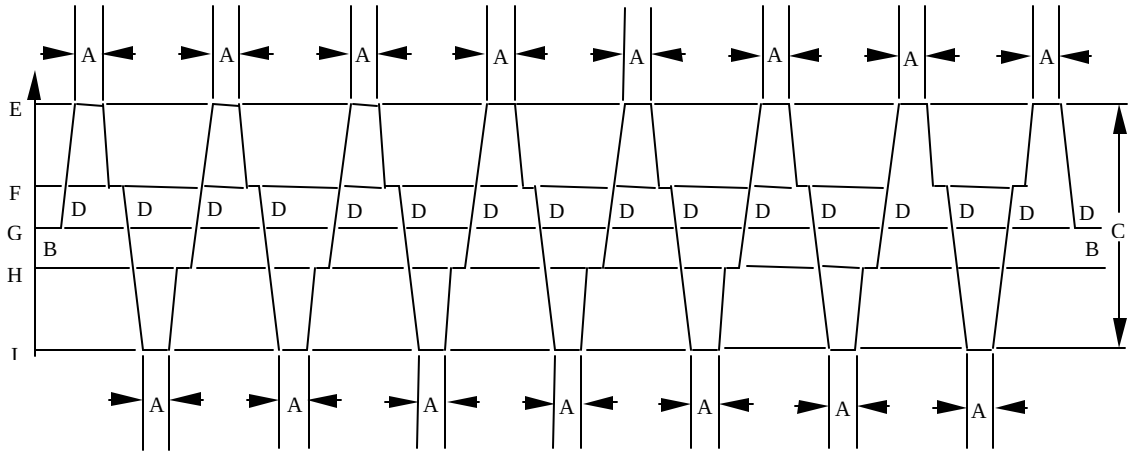
4.3.1 Thermal Cycle Tests

HRF payloads undergoing thermal cycle testing shall be functionally tested at each stable temperature and during transitions. The pass-fail criteria for the functional test and the definition of the functional test will be equipment unique and shall be

defined in the test plan and test procedure. Functional tests shall be conducted on end items prior to, during, and after environmental exposure. (LS-71000A, Section 5.4.1.1.6)

4.3.1.1 Qualification Thermal Cycling

The Qualification Thermal Cycle Test shall be over a range of 110 °F (61.1 °C) centered about the normal operating temperature as defined in the individual test plans. The Qualification thermal test shall consist of 7½ cycles. One cycle is defined as starting from normal operating temperature, increasing to the maximum high temperature, decreasing to the minimum low temperature and then returning to the normal operating temperature as depicted in Figure 4.3.1.1-1. The complete test is seven and one-half (7½) cycles with one-hour soaks at each extreme. The hardware will be functionally tested during transitions and at the highest and lowest temperature extremes, consistent with the defined operating temperature range. The hardware shall not be functionally tested at temperatures in excess of the defined operating temperature range. (Hardware shall be unpowered when outside the manufacturer's operating limits.) The specific profile shall be defined in the individual test plans. (LS-71000A, Section 5.4.1.1.6.1)

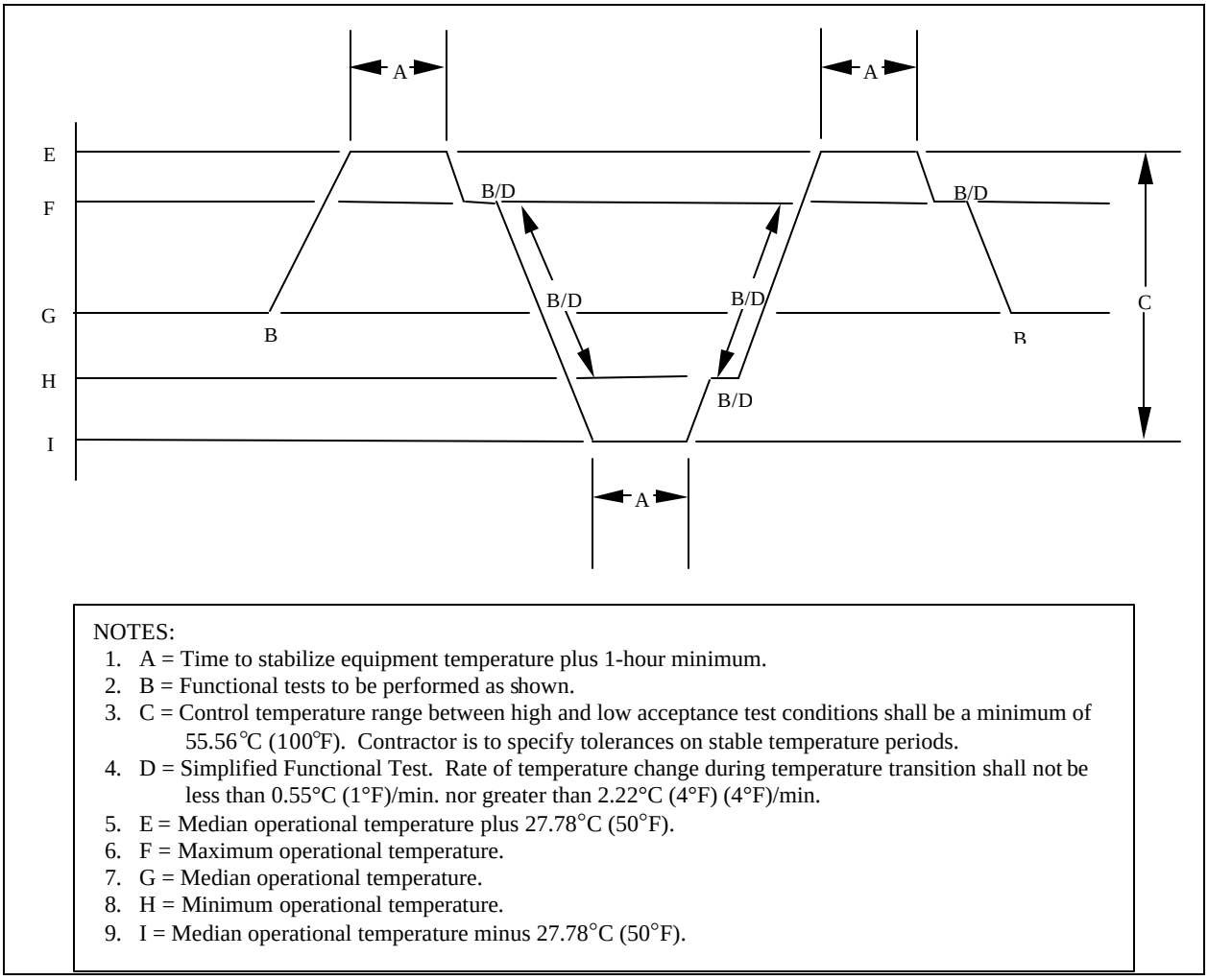


NOTES:
1. A = Time to stabilize equipment temperature plus 1-hour minimum.
2. B = Functional tests to be performed as shown.
3. C = Control temperature range between high and low acceptance test conditions shall be a minimum of 61.11°C (110°F). Contractor is to specify tolerances on stable temperature periods.
4. D = Simplified Functional Test. Rate of temperature change during temperature transition shall not be less than 0.55°C (1°F)/min. nor greater than 2.22°C (4°F) (4°F)/min.
5. E = Median operational temperature plus 30.56°C (55°F).
6. F = Maximum operational temperature.
7. G = Median operational temperature.
8. H = Minimum operational temperature.
9. I = Median operational temperature minus 30.56°C (55°F).

Figure 4.3.1.1-1. Qualification Thermal Cycling

4.3.1.2 Acceptance Thermal Cycling

The acceptance thermal cycle shall be conducted over a temperature range of 100 °F (55.6 °C) centered about the hardware normal operating temperature as defined in the test plan. The hardware shall be functionally tested before and after the temperature test, at each transition, and at each stable temperature. The hardware shall not be functionally tested at temperatures in excess of the defined operating temperature range. (Hardware shall be unpowered when outside the manufacturer's operating limits.) One cycle is defined as starting from normal operating temperature, increasing to the maximum high temperature, decreasing to the minimum low temperature and then returning to the normal operating temperature as depicted in Figure 4.3.1.2-1. The complete test consists of one and one-half (1½) thermal cycles with one-hour soaks at each extreme. Minimum temperature sweep shall be 100 °F around the normal operating temperature, and the hardware shall dwell at the temperature extremes for a minimum of 1 hour. (LS-71000A, Section 5.4.1.1.6.2)



NOTES:
1. A = Time to stabilize equipment temperature plus 1-hour minimum.
2. B = Functional tests to be performed as shown.
3. C = Control temperature range between high and low acceptance test conditions shall be a minimum of 55.56°C (100°F). Contractor is to specify tolerances on stable temperature periods.
4. D = Simplified Functional Test. Rate of temperature change during temperature transition shall not be less than 0.55°C (1°F)/min. nor greater than 2.22°C (4°F) (4°F)/min.
5. E = Median operational temperature plus 27.78°C (50°F).
6. F = Maximum operational temperature.
7. G = Median operational temperature.
8. H = Minimum operational temperature.
9. I = Median operational temperature minus 27.78°C (50°F).

Figure 4.3.1.2-1. Acceptance Thermal Cycling

4.3.2 Vibration Tests

Qualification for Acceptance Random Vibration Test levels are as described in Section 4.3.2.1. Acceptance Random Vibration Test levels are as described in Section 4.3.2.2.

4.3.2.1 Qualification for Acceptance Random Vibration Test

Qualification for Acceptance Vibration Testing (QAVT) determines the number of Acceptance Vibration Tests that may be run on flight units. QAVT shall be run on dedicated qualification test hardware only. The QAVT for HRF equipment shall be performed at a 7.93 g rms composite level over the frequency range and spectral density defined in Table 4.3.2.1-1. QAVT shall be conducted at 1.69 times the Acceptance Random Vibration Test levels. QAVT duration shall be the Acceptance Vibration Testing (AVT) duration multiplied by the number of AVTs for which the hardware is to be qualified. (LS-71000A, Section 5.4.1.1.3.2)

TABLE 4.3.2.1-1. QUALIFICATION ACCEPTANCE RANDOM VIBRATION TEST LEVELS

Frequency Range (Hz)	Minimum Power Spectral Density (g^2/Hz)
20	0.017
20 - 80	3 dB/Octave Slope
80 - 350	0.067
350 - 2000	-3 dB/Octave Slope
2000	0.0118
Composite	7.93 g rms

4.3.2.2 Acceptance Random Vibration Test

AVT is used to screen defects in workmanship that cannot be detected by inspection. AVT for FGI Flight Calibration Unit shall be performed at a 6.1 g rms composite level over the frequency range and minimum AVT levels defined in Table 4.3.2.2-1. Vibration duration shall be a minimum of 60 seconds in each of three axes. Functional/continuity tests shall be conducted on components before, during, and after the AVT. (LS-71000A Section 5.4.1.1.3.3)

TABLE 4.3.2.2-1. ACCEPTANCE RANDOM VIBRATION WORKMANSHIP TEST LEVELS

Frequency Range (Hz)	Minimum Power Spectral Density (g^2/Hz)
20	0.01
20 - 80	+3 dB/Octave - Slope
80 - 350	0.04
350 - 2000	-3 dB/Octave - Slope
2000	0.007
Composite	6.1 g rms

4.3.3 Functional Testing

Abbreviated and full functional test procedures shall be as specified in a TPS or a released procedure.

Functional tests are performed to validate the operation of the FGI Flight Calibration Unit flight hardware. Functionals make up the core of certain tests and can be performed before and after environmental testing. The functional test done prior to testing establishes the functional state (or baseline) of the hardware while the functional done after testing evaluates its ability to withstand the test levels.

An abbreviated functional will be used to test the functional state of the hardware during some environmental testing (i.e., thermal, vibration, bench handling, etc.). The intended use of an abbreviated functional is to verify nominal hardware function between test stages.

4.3.4 Electrical, Electronic, and Electromechanical Parts Control, Selection, and Burn-In

A. Compliance with 3.4.4.A is considered successful when it can be shown via analysis that the parts control process is compliant with 3.4.4.A.

B. Compliance with 3.4.4.B is considered successful when an analysis is provided which includes a risk assessment, electrical stress analysis, and data delivery on information such as designed/as-built EEE parts, list, construction history, Government and Industry Data Exchange Program (GIDEP) Alerts, part obsolescence, radiation susceptibility, and/or prior history.

C. The burn-in test may be accomplished at the component or assembly level, and is specified as:

- 72 hrs continuously at room ambient temperature while functioning
- 96 hrs continuously at a specified controlled temperature while functioning.

Full functional tests shall be performed on the experiment hardware before and after the burn-in test. Controlled temperature is defined as 15 °C below the maximum rating of the device with the lowest temperature rating in the article under test. (LS-71000A, Section 5.4.1.1.10)

All flight assemblies utilizing non-military parts (as specified in Section 3.4.4) shall undergo burn-in testing. (LS-71000A, Section 5.4.1.1.10)

4.3.5 Flammability

Payload materials shall be non-flammable or self-extinguishing per the test criteria of NASA-STD-6001, Test 1, Flammability, Odor, Offgassing, and Compatibility Requirements and Test Procedures for Materials in Environments that Support Combustion. The material shall be evaluated in the worst-case use environment at the worst-case use configuration. When the use of a nonflammable material is not possible, a Material Usage Agreement (MUA) or equivalent shall be submitted to the cognizant NASA center for disposition. If test data does not exist for a material, the experimenter may be asked to provide samples (see NASA-STD-6001, Chapter 4) to a NASA certified test facility Marshall Space Flight Center (MSFC) or White Sands Test Facility (WSTF) for flammability testing.

Materials transported or operated in the orbiter cabin, or operated in the ISS air lock during Extravehicular Activity (EVA) preparations, shall be tested and evaluated for flammability in the worst-case use environment of 30% oxygen and 10.2 psia. Materials used in all other habitable areas shall be tested and evaluated in the worst-case use environment of 24.1% oxygen and 15.2 psia. (LS-71000A, Section 5.4.1.1.8)

4.3.6 Offgassing

All flight hardware located in habitable areas shall be subjected to test and meet the toxicity offgassing acceptance requirements of NASA-STD-6001, Test 7. (LS-71000A, Section 5.4.1.1.9)

4.3.7 Bench Handling

A bench handling test shall be performed on the qualification unit for all hardware. If there is no qualification unit, analysis may be substituted for test. The bench handling test shall be conducted in accordance with MIL-STD-810, Section 516.4, I3.6, Procedure 4 or 6 with the following modifications: Test conditions of 26 drops altered to two (2) drops. Surfaces, corners, edges shall be identified in the test procedure. (LS-71000A, Section 5.4.1.1.5)

4.3.8 Payload Mass

FGI Flight Calibration Unit shall comply with LS-71014, “Mass Properties Control Plan.” (LS-71000A, Section 5.4.1.1.1)

4.3.9 Electromagnetic Compatibility

The FGI Flight Calibration Unit shall comply with LS-71016, "HRF EMI/EMC Control Plan." (LS-71000A, Section 5.4.1.2.1)

4.3.10 Acoustic Noise

FGI Flight Calibration Unit shall comply with LS-71011, "Acoustic Noise Control and Analysis Plan for Human Research Facility Payloads and Racks." (LS-71000A, Section 5.4.1.1.7)

4.3.11 Pre-Delivery Acceptance

The responsible manufacturing parties shall perform a PDA after the complete fabrication and assembly has been conducted for all Class I deliverable assemblies. This test shall include verification of software interface and operation. The PDA must be completed before hardware certification testing begins. It is a full functional test and inspection that validates that the hardware operates per the design requirements and that it is constructed per released engineering drawings. All PDA tests shall be approved by the hardware's JSC technical monitor and JSC/NT3, as well as the contractor quality engineering (if applicable). The following are standard steps that each PDA test shall contain:

1. Conformance to Drawing. Verify that the hardware conforms to released engineering drawings.
2. No Sharp Edges. Inspect the hardware to verify that there are no sharp edges or corners present.
3. Proper Identifying Markings. Verify that the hardware has the proper part number and serial number (if applicable) on it.
4. Cleanliness. All PDA tests shall include verification that all surfaces (external, internal, etc.) are to the cleanliness level of Section 3.3.1.1C of this document.

5.0 PREPARATION FOR SHIPMENT

5.1 GENERAL

A. The methods of preservation, packaging, and packing used for shipment, together with necessary special control during transportation, shall adequately protect the article(s) from damage or degradation in reliability or performance as a result of the natural and induced environments encountered during transportation and subsequent indoor storage. (LS-71000A, Section 9.1A)

B. To reduce program cost, prior to developing a newly designed container, every effort will be made by project participants to use container designs and/or containers available commercially or from Government inventories. If reusable containers are not available, a screening process should be initiated for container availability in the following priority: existing containers, COTS containers, and modified COTS containers. Shipping containers and protective devices will be designed for effective and economical manufacture, procurement, and transportability. (LS-71000A, Section 9.1B)

5.2 PACKING, HANDLING, AND TRANSPORTATION

A. Packaging, handling, and transportation shall be in accordance with applicable requirements of NHB 6000.1C, and referenced documents therein. (LS-71000A, Section 9.2A)

B. Documented procedures and physical controls shall be established to ensure that the HRF rack and individual items of equipment will not be subjected to temperature, shock, and humidity outside the non-operational limits during shipment. LS-71000A, Section 9.2C)

C. The FGI Flight Calibration Unit shall be cleaned to the "Visibly Clean Level 1 (Sensitive)" as determined in JSC-SN-C-0005, Specification Contamination Control Requirements for the Shuttle Program. (LS-71000A, Section 9.2D)

5.3 PRESERVATION AND PACKING

Preservation and packing shall be in accordance with approved Packaging, Handling, and Transportation Records (PHTRs). (LS-71000A, Section 9.3)

5.4 MARKING FOR SHIPMENT

Interior and exterior containers shall be marked and labeled in accordance with NHB 6000.1C, including precautionary markings necessary to ensure safety of personnel and facilities, and to ensure safe handling, transport, and storage. Should the individual items of equipment contain any hazardous materials, markings shall also comply with applicable requirements governing packaging and labeling of hazard materials. Packages with reuse capability shall be identified with the words "Reusable Container - Do Not Destroy - Retain for Reuse." NASA Critical Item Labels (Form 1368 series) shall be applied in accordance with NHB 6000.1C.

(LS-71000A, Section 9.4)

5.5 NASA CRITICAL SPACE ITEM LABEL

The NASA Critical Space Item Labels Form 1368 shall be affixed to exterior and interior shipping containers in accordance with NHB 6000.1C. (LS-71000A, Section 9.5A)

6.0 NOTES

This section contains information of a general or explanatory nature that may be helpful but is not mandatory.

6.1 DEFINITIONS

Qualification Test	Test conducted as part of the verification program to demonstrate that the design and performance requirements can be realized under specified conditions.
Acceptance Test	Formal tests conducted to assure that the end item meets specified requirements. Acceptance tests include performance demonstrations and environmental exposures to screen out manufacturing defects, workmanship errors, incipient failures, and other performance anomalies not readily detectable by normal inspection techniques or through ambient functional tests.
Active Air Exchange	Forced convection between two volumes. For example, forced convection between a subrack payload and the internal volume of an integrated rack, or forced convection between a subrack payload and cabin air.
Continuous Noise Source	A significant noise source, which exists for a cumulative total of eight hours or more in any 24-hour period, is considered to be a continuous noise source.
Intermittent Noise Source	A significant noise source, which exists for a cumulative total of less than eight hours in a 24-hour period, is considered to be an intermittent source.

APPENDIX A

RESERVED

APPENDIX B

ISS PRESSURIZED PAYLOAD INTERFACE REQUIREMENTS DOCUMENT VERIFICATION MATRIX

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ISS PRESSURIZED PAYLOAD INTERFACE REQUIREMENTS DOCUMENT VERIFICATION MATRIX

SRD Section	LS-71000A Section	SSP 57000 Section	Requirement	Applicable	GPVP VDS #	Responsibility	Comments
3.2.2.2.2.1.1	6.4.4.1.1	3.1.1.7.1	On-Orbit Permanent Protrusions	N/A	ME-059		Equipment will be a temporary protrusion.
3.2.2.2.2.1.2A	6.4.4.1.2A	3.1.1.7.2A	On-Orbit Semi-Permanent Protrusions	N/A	ME-059		Equipment will be a temporary protrusion.
3.2.2.2.2.1.2B	6.4.4.1.2B	3.1.1.7.2B	On-Orbit Semi-Permanent Protrusions - Easily Stowable	N/A	ME-059		Equipment will be a temporary protrusion.
3.2.2.2.2.1.3	6.4.4.1.3	3.1.1.7.3	On-Orbit Temporary Protrusions	E	ME-059		
3.2.2.2.2.1.4	6.4.4.1.4	3.1.1.7.4	On-Orbit Momentary Protrusions	N/A	ME-059		Equipment will be a temporary protrusion.
3.2.4A	6.4.4.2.6.3	3.12.4.2.8.4	Maintainability - Unique Tools	N/A	ME-016		No on-orbit maintenance.
3.2.4B	6.4.4.3.1	3.12.4.3.1	Maintainability - One-handed Operation	N/A	ME-017		No on-orbit maintenance.
3.2.4C	6.4.4.3.2B	3.12.4.3.2A2	Maintainability - Connector Mate/Demate	N/A	ME-018		No on-orbit maintenance.
3.2.4D	6.4.4.3.2C	3.12.4.3.2B	Maintainability - No Damage to Wiring Connectors	N/A	ME-018		No on-orbit maintenance.
3.2.4E	6.4.4.2.6	3.12.4.2.8	Maintainability - Access to Hardware Items	N/A	ME-042		No on-orbit maintenance.
3.2.4F	6.4.3.1.2A	3.12.3.1.2A	Maintainability - Built-in Control	N/A	ME-008		No on-orbit maintenance.
3.2.4G	6.4.3.1.2B	3.12.3.1.2B	Maintainability - Access to Filters for Replacement/Cleaning	N/A	ME-008		No on-orbit maintenance.
3.2.4.1.1	6.4.10	3.12.10	Payload In-flight Maintenance	N/A	ME-003		No on-orbit maintenance.
3.2.5.1.1.1	6.3.6.1.1	3.9.1.1	Pressure	✓	Safety		
3.2.5.1.1.2	6.3.6.1.2	3.9.1.2	Temperature	✓	Safety		
3.2.5.1.1.3	6.3.6.1.3	3.9.1.3	Humidity	N/A	EN-001		Equipment will be at or above ambient temperature and will not cause condensation.

✓ - Requirement is applicable E - Exception N/A - Requirement is not applicable

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SRD Section	LS-71000A Section	SSP 57000 Section	Requirement	Applicable	GPVP VDS #	Responsibility	Comments
3.2.5.1.2.1	6.3.6.2.1	3.9.2.1A	Active Air Exchange	N/A	EN-002		Equipment does not exchange air with cabin.
3.2.5.1.2.3	6.3.6.2.3	3.9.2.3	Chemical Releases	✓	Safety		
3.2.5.1.2.5	6.3.4.3	3.5.1.13	Cabin Air Cooling	N/A	FD-009		Equipment does not require cooling.
3.2.5.1.3.1	6.3.6.3.1	3.9.3.1	Instrument Contained or Generated Ionizing Radiation	N/A	Safety		Equipment does not generate ionizing radiation.
3.2.5.1.3.3	6.3.6.3.3	3.9.3.3	Single Event Effect (SEE) Ionizing Radiation	✓	EN-004		
3.2.5.1.5A	6.3.1.2B	3.1.1.4B	Pressure Rate of Change - On-orbit	✓	ST-003		
3.2.5.1.5C1	6.3.1.2A	3.1.1.2B	Pressure Rate of Change - MPLM	✓	ST-003		
3.2.5.1.5D	6.3.1.2C	3.1.1.4K	Pressure Rate of Change - Portable Fire Extinguisher (PFE)	N/A	ST-003		Equipment does not have a PFE access port.
3.2.5.2.1	6.4.3.3.1C	3.12.3.3.1C	Continuous Noise Limits	✓	EN-006		
3.2.5.2.2A	6.4.3.3.2A	3.12.3.3.2A	Intermittent Noise Limits - A-weighted SPL Limits	N/A	EN-006		Equipment shall meet continuous noise source requirements.
3.2.5.2.2B	6.4.3.3.2	3.12.3.3.2B	Intermittent Noise Limits - Cumulative Duration	N/A	EN-006		Equipment shall meet continuous noise source requirements.
3.2.5.3	6.3.4.1	3.5.1.11	Instrument Surface Temperature	N/A	FD-032		Not a rack.
3.2.7.1.1		3.1.1.6.1	Connector Physical Mate	N/A	EL-007 ME-056		Equipment does not mate directly with ISS.
3.2.7.2.1.1	6.3.2.4	3.2.4	EMC	N/A	EL-020		Equipment does not interface with UOP or UIP.
3.2.7.2.1.1.1	6.3.2.4.1	3.2.4.1	Electrical Grounding	N/A	EL-021		Equipment is powered by a 9V battery.
3.2.7.2.1.1.2	6.3.2.4.2	3.2.4.2	Electrical Bonding	N/A	EL-022		Equipment is powered by a 9V battery.
3.2.7.2.1.2A	6.3.2.4.4	3.2.4.4	Electromagnetic Interference	✓	EL-020		

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SRD Section	LS-71000A Section	SSP 57000 Section	Requirement	Applicable	GPVP VDS #	Responsibility	Comments
3.2.7.2.1.2B	6.3.2.4.4	3.2.4.4	Electromagnetic Interference - Alternative Use of RS03PL	✓	EL-020		
3.2.7.2.2A	6.3.2.5	3.2.4.5	ESD ≤ 4000V	✓	EL-024		
3.2.7.2.2B	6.3.2.5	3.2.4.5	ESD between 4000V and 15000V - Labeling EPCE	✓	EL-024		
3.2.7.2.2C	6.3.2.5	3.2.4.5	ESD Labeling	✓	EL-024		
3.2.7.2.3	6.3.2.8	3.2.4.8	Corona	✓	EL-024		
3.2.7.2.4	6.3.2.4.3	3.2.4.3	Cable/Wire Design and Control Requirements	N/A	EL-021		Equipment has no cables.
3.2.7.2.4.1B	6.3.2.1B	3.2.3.1B	Wire Derating	N/A	EL-017		Not connected to rack. Equipment is battery powered.
3.2.7.2.4.2	6.3.2.2	3.2.3.2B	Exclusive Power Feeds	N/A	EL-018		Equipment has no cables.
3.2.7.2.5	6.3.2.3	3.2.3.3	Loss of Power	N/A	Safety		Equipment is powered by a 9V battery.
3.2.7.2.6	6.3.2.6	3.2.4.6	AC Magnetic Fields	✓	EL-020		
3.2.7.2.7	6.3.2.7	3.2.4.7	DC Magnetic Fields	✓	EL-020		
3.2.7.3.1.1	6.3.3.1.1	3.3.2.1	Word/Byte Notations	N/A	CD-001		Equipment has no C&DH capabilities.
3.2.7.3.1.2	6.3.3.1.2	3.3.2.2	Data Types	N/A	CD-001		Equipment has no C&DH capabilities.
3.2.7.4.1	6.3.7.1	3.10.1	Fire Prevention	✓	Safety		
3.2.7.4.2.1A	6.3.7.2.1A	3.10.3.1A	PFE - Small Access Port	N/A	ME-055		Equipment has no forced air flow.
3.2.7.4.2.1B	6.3.7.2.1B	3.10.3.1B	PFE - Large Access Port	N/A	ME-055		Equipment has no forced air flow.
3.2.7.4.2.2	6.3.7.2.2	3.10.3.2	Fire Suppression Access Port Accessibility	N/A	ME-055		Equipment has no PFE access port.
3.2.7.4.2.3	6.3.7.2.3	3.10.3.3	Fire Suppressant Distribution	N/A	ME-055		Equipment has no PFE access port.
3.2.7.4.3	6.3.7.3	3.10.4A	Labeling	N/A	ME-055		Equipment has no PFE access port.

✓ - Requirement is applicable E - Exception N/A - Requirement is not applicable

ISS PRESSURIZED PAYLOAD INTERFACE REQUIREMENTS DOCUMENT VERIFICATION MATRIX (Cont'd)

SRD Section	LS-71000A Section	SSP 57000 Section	Requirement	Applicable	GPVP VDS #	Responsibility	Comments
3.2.7.5.2	6.2.7.1.2	3.7.1.1	Nitrogen Interface Control	✓			
3.2.7.5.3	6.2.7.1.3	3.7.1.2	Nitrogen Interface MDP	✓			
3.2.7.5.4	6.2.7.1.4	3.7.1.3	Nitrogen Interface Temperature	✓			
3.2.7.5.5	6.2.7.1.5	3.7.1.4	Nitrogen Leakage	✓			
3.3.1.1A	6.3.8.1	3.11.1	Materials and Processes	✓	Safety		
3.3.1.1B	6.3.8.2	3.11.1.1	Materials and Processes - Commercial Parts	✓	Safety		
3.3.1.1C	6.3.8.3	3.11.3	Materials and Processes - Cleanliness	✓	MP-002		
3.3.1.1D	6.4.3.1.4	3.12.3.1.6	Materials and Processes - Surface Materials	N/A	MP-004		Requirement deleted in SSP 57000 Rev D.
3.3.1.1E	6.3.8.4	3.11.4	Materials and Processes - Fungus Resistant Materials	✓	MP-003		
3.3.1.2	6.4.9.2	3.12.9.2	Sharp Edges	✓	Safety		
3.3.1.3	6.4.9.3	3.12.9.3	Holes	✓	ME-007		
3.3.1.4	6.4.9.4	3.12.9.4	Latches	✓	ME-027		
3.3.1.5	6.4.9.5	3.12.9.5	Screws and Bolts	✓	ME-026		
3.3.1.6	6.4.9.6	3.12.9.6	Securing Pins	✓	ME-053		
3.3.1.7	6.4.9.7	3.12.9.7	Levers, Cranks, Hooks, and Controls	✓	ME-053		
3.3.1.8	6.4.9.8	3.12.9.8	Burrs	✓	ME-053		
3.3.1.9	6.4.9.9A	3.12.9.9A	Locking Wires	N/A	ST-009		Equipment has no on-orbit removable or replaceable parts.
3.3.2.1	6.4.7	3.12.7	Equipment Identification	✓	ME-057		
3.3.5.1.1	6.3.2.10.1	3.2.5.1.1	Mating/Demating of Powered Connectors	N/A	Safety		Equipment has no electrical connectors.
3.3.5.1.2A	6.3.2.10.3A	3.2.5.3A	Power Switches/Controls -Open Supply Circuit Conductors	N/A	EL-029		Equipment does not interface with UOP.

✓ - Requirement is applicable E - Exception N/A - Requirement is not applicable

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SRD Section	LS-71000A Section	SSP 57000 Section	Requirement	Applicable	GPVP VDS #	Responsibility	Comments
3.3.5.1.2B	6.3.2.10.3B	3.2.5.3B	Power Switches/Controls -Power-off Markings/Indications	N/A	EL-029		Equipment does not interface with UOP.
3.3.5.1.2C	6.3.2.10.3C	3.2.5.3C	Power Switches/Controls -Supply Circuit not Completely Disconnected	N/A	EL-029		Equipment does not interface with UOP.
3.3.5.1.3A	6.3.2.10.4A	3.2.5.4A	Ground Fault Circuit Interrupter (GFCI) - Output Voltages > 30 V rms	N/A	EL-030		Equipment is powered by a 9V battery.
3.3.5.1.3B	6.3.2.10.4B	3.2.5.4B	GFCI - DC Detection Independent of Safety Wire	N/A	EL-030		Equipment is powered by a 9V battery.
3.3.5.1.3C	6.3.2.10.4C	3.2.5.4C	GFCI - AC Detection Dependent on Safety Wire	N/A	EL-030		Equipment is powered by a 9V battery.
3.3.5.1.3D	6.3.2.10.4D	3.2.5.4D	GFCI - EUE Generating Internal Voltages > 30 V rms	N/A	EL-030		Equipment is powered by a 9V battery.
3.3.5.1.3E	6.3.2.10.4E	3.2.5.4E	GFCI - Trip Current	N/A	EL-030		Equipment is powered by a 9V battery.
3.3.5.1.3F	6.3.2.10.4F	3.2.5.4F	GFCI - Power Removal Time	N/A	EL-030		Equipment is powered by a 9V battery.
3.3.5.1.3G	6.3.2.10.4G	3.2.5.4G	GFCI - On-Orbit Testing	N/A	EL-030		Equipment is powered by a 9V battery.
3.3.5.1.4A	6.3.2.10.5A	3.2.5.5A	Portable Equipment/Power Cords - Non-battery Powered Portable EUE	N/A	EL-031		Equipment is powered by a 9V battery.
3.3.5.1.4B	6.3.2.10.5B	3.2.5.5B	Portable Equipment/Power Cords - Fault Currents	N/A	EL-031		Equipment is powered by a 9V battery.
3.3.6.1	6.4.3.1.1	3.12.3.1.1	Closures or Covers Design Requirements	✓	ME-007		
3.3.6.3A	6.4.2.3	3.12.2.3	Full Size Range Accommodation	✓	ME-006		
3.3.6.4A	6.4.1.1A	3.12.1A1	Grip Strength	✓	ST-005		
3.3.6.4B	6.4.1.1B	3.12.1A2	Linear Forces	✓	ST-005		
3.3.6.4C	6.4.1.1C	3.12.1A3	Torque	✓	ST-005		
3.3.6.5	6.4.1.2	3.12.1B	Maintenance Operations	N/A	ST-005		No on-orbit maintenance.

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ISS PRESSURIZED PAYLOAD INTERFACE REQUIREMENTS DOCUMENT VERIFICATION MATRIX (Cont'd)

SRD Section	LS-71000A Section	SSP 57000 Section	Requirement	Applicable	GPVP VDS #	Responsibility	Comments
3.3.6.6	6.4.2.1	3.12.2.1	Adequate Clearance	N/A	ME-021		Not a rack.
3.3.6.7A	6.4.2.2A	3.12.2.2A	Accessibility - Geometric Arrangement	✓	ME-021		
3.3.6.7B	6.4.2.2B	3.12.2.2B	Accessibility - Access Openings for Fingers	✓	ME-021		
3.3.6.8	6.4.3.1.3	3.12.3.1.5	One-Handed Operation	N/A	ME-009		Equipment has no unique cleaning equipment.
3.3.6.9	6.4.3.2.1	3.12.3.2.1	Continuous/Incidental Contact - High Temperature	✓	Safety		
3.3.6.10	6.4.3.2.2	3.12.3.2.2	Continuous/Incidental Contact - Low Temperature	N/A	Safety		Equipment has no cooling.
3.3.6.11	6.4.4.2.1	3.12.4.2.1	Equipment Mounting	✓	ME-011		
3.3.6.12A	6.4.4.2.2A	3.12.4.2.2	Drawers and Hinged Panels - for routine checkout of P/L ORUs	N/A	ME-012		No on-orbit maintenance
3.3.6.12B	6.4.4.2.2B	3.12.4.2.2	Drawers and Hinged Panels - remain open without manual support	N/A	ME-012		No on-orbit maintenance
3.3.6.13	6.4.4.2.3	3.12.4.2.5	Alignment	N/A	ME-013		Equipment has no blind mate connectors.
3.3.6.14	6.4.4.2.5	3.12.4.2.7	Push-Pull Force	✓	ST-006		
3.3.6.15A	6.4.4.2.6.1A	3.12.4.2.8.1A	Covers - sliding or hinged cap or door	✓	ME-007		
3.3.6.15B	6.4.4.2.6.1B	3.12.4.2.8.1B	Covers - quick-opening cover plate	✓	ME-007		
3.3.6.16	6.4.4.2.6.2	3.12.4.2.8.2	Self-Supporting Covers	N/A	ME-007		Equipment has no access covers.
3.3.6.17	6.4.4.3.2A	3.12.4.3.2A1	Accessibility	✓	ME-018		
3.3.6.18	6.4.4.3.3	3.12.4.3.3	Ease of Disconnect	N/A	ME-017		Equipment has no electrical connectors.
3.3.6.19	6.4.4.3.5	3.12.4.3.5	Self Locking	N/A	ME-017		Equipment has no electrical connectors.
3.3.6.20A	6.4.4.3.6A	3.12.4.3.6A	Connector Arrangement - Space between Connectors and Adjacent Obstructions	✓	ME-018		

✓ - Requirement is applicable E - Exception N/A - Requirement is not applicable

SRD Section	LS-71000A Section	SSP 57000 Section	Requirement	Applicable	GPVP VDS #	Responsibility	Comments
3.3.6.20B	6.4.4.3.6B	3.12.4.3.6B	Connector Arrangement - Space between Connectors in a Row	N/A	ME-018		Equipment only has one connector.
3.3.6.21	6.4.4.3.7	3.12.4.3.7	Arc Containment	N/A	EL-026		Equipment has no electrical connector plugs.
3.3.6.22	6.4.4.3.8	3.12.4.3.8	Connector Protection	✓	ME-019		
3.3.6.23	6.4.4.3.9	3.12.4.3.9	Connector Shape	N/A	ME-019		Equipment only has one connector.
3.3.6.24	6.4.4.3.11	3.12.4.3.11A	Alignment Marks or Guide Pins	✓	ME-020		
3.3.6.25A	6.4.4.3.12A	3.12.4.3.12A	Coding - Unique to Connection	✓	ME-020		
3.3.6.25B	6.4.4.3.12B	3.12.4.3.12B	Coding - Visible	✓	ME-020		
3.3.6.26	6.4.4.3.13	3.12.4.3.13	Pin Identification	N/A	EL-007		Equipment has no electrical connectors.
3.3.6.27	6.4.4.3.14	3.12.4.3.14	Orientation	N/A	ME-020		Equipment has no electrical connectors.
3.3.6.28A	6.4.4.3.15A	3.12.4.3.15A	Hose/Cable Restraints - Loose Ends	N/A	ME-022		Hose will be used for short durations.
3.3.6.28B	6.4.4.3.15B	3.12.4.3.15B	Hose/Cable Restraints - Clamps	N/A	ME-022		Hose will be used for short durations.
3.3.6.28D	6.4.4.3.15D	3.12.4.3.15D	Hose/Cable Restraints - Lengths	N/A	ME-022		Hose will be used for short durations.
3.3.6.29	6.4.4.4.1	3.12.4.4.1	Non-Threaded Fasteners Status Indication	N/A	ME-023		No on-orbit maintenance.
3.3.6.30	6.4.4.4.2	3.12.4.4.2	Mounting Bolt/Fastener Spacing	N/A	ME-024		No on-orbit maintenance.
3.3.6.31	6.4.4.4.3	3.12.4.4.4A	Multiple Fasteners	✓	ME-025		
3.3.6.32	6.4.4.4.4	3.12.4.4.5	Captive Fasteners	N/A	ME-026		No on-orbit maintenance.
3.3.6.33A	6.4.4.4.5A	3.12.4.4.6A	Quick Release Fasteners - One turn max	N/A	ME-026		No on-orbit maintenance.
3.3.6.33B	6.4.4.4.5B	3.12.4.4.6B	Quick Release Fasteners - Positive Locking	N/A	ME-026		No on-orbit maintenance.
3.3.6.34	6.4.4.4.6	3.12.4.4.7	Threaded Fasteners	N/A	ME-026		No on-orbit maintenance.
3.3.6.35A	6.4.4.4.7A	3.12.4.4.8A	Over Center Latches - Nonself-latching	N/A	ME-027		No on-orbit maintenance.

✓ - Requirement is applicable E - Exception N/A - Requirement is not applicable

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3.3.6.35B	6.4.4.4.7B	3.12.4.4.8B	Over Center Latches - Latch Lock	N/A	ME-027		No on-orbit maintenance.
3.3.6.35C	6.4.4.4.7C	3.12.4.4.8C	Over Center Latches - Latch Handles	N/A	ME-027		No on-orbit maintenance.
3.3.6.36	6.4.4.4.8	3.12.4.4.9	Winghead Fasteners	N/A	ME-026		No on-orbit maintenance.
3.3.6.37A	6.4.4.4.9A	3.12.4.4.11A	Fastener Head Type - On-Orbit Crew Actuation	N/A	ME-028		No on-orbit maintenance.
3.3.6.37B	6.4.4.4.9B	3.12.4.4.11B	Fastener Head Type - Smooth Surface	✓	ME-028		
3.3.6.37C	6.4.4.4.9C	3.12.4.4.11C	Fastener Head Type - Slotted Fasteners	N/A	ME-028		No on-orbit maintenance.
3.3.6.38	6.4.4.4.10	3.12.4.4.12	One-Handed Actuation	N/A	ME-029		No on-orbit maintenance.
3.3.6.39	6.4.4.4.11	3.12.4.4.13	Accessibility	N/A	ME-024		No on-orbit maintenance.
3.3.6.40	6.4.4.4.12	3.12.4.4.14	Access Holes	N/A	ME-024		No on-orbit maintenance.
3.3.6.41	6.4.5.1	3.12.5.1	Controls Spacing Design Requirements	✓	ME-030		
3.3.6.42A	6.4.5.2.1A	3.12.5.2.1A	Protective Methods - Location/Orientation	✓	ME-031		
3.3.6.42B	6.4.5.2.1B	3.12.5.2.1B	Protective Methods - Recess/Shielding	✓	ME-031		
3.3.6.42C	6.4.5.2.1C	3.12.5.2.1C	Protective Methods - Cover/Guard, No Safety or Lock Wire	✓	ME-031		
3.3.6.42D	6.4.5.2.1D	3.12.5.2.1D	Protective Methods - Obscuration by Cover Guards	✓	ME-031		
3.3.6.42E	6.4.5.2.1E	3.12.5.2.1E	Protective Methods - Interlocks	✓	ME-031		
3.3.6.42F	6.4.5.2.1F	3.12.5.2.1F	Protective Methods - Resistance	✓	ME-031		
3.3.6.42G	6.4.5.2.1G	3.12.5.2.1G	Protective Methods - Position Locks for Sequencing	✓	ME-031		
3.3.6.43	6.4.5.2.2	3.12.5.2.2	Noninterference	✓	ME-030		
3.3.6.44	6.4.5.2.3	3.12.5.2.3	Dead-Man Controls	N/A	Safety		Equipment has no dead-man controls.

✓ - Requirement is applicable E - Exception N/A - Requirement is not applicable

ISS PRESSURIZED PAYLOAD INTERFACE REQUIREMENTS DOCUMENT VERIFICATION MATRIX (Cont'd)

SRD Section	LS-71000A Section	SSP 57000 Section	Requirement	Applicable	GPVP VDS #	Responsibility	Comments
3.3.6.45	6.4.5.2.4	3.12.5.2.4	Barrier Guards	N/A	ME-030		Equipment has no barrier guards.
3.3.6.46	6.4.5.2.5	3.12.5.2.5	Recessed Switch Protection	N/A	ME-031		Equipment has no critical functions.
3.3.6.47	6.4.5.2.7	3.12.5.2.7	Position Indication	N/A	ME-032		Equipment has no protective covers.
3.3.6.48	6.4.5.2.8	3.12.5.2.8	Hidden Controls	N/A	ME-031		Equipment has no hidden controls.
3.3.6.49	6.4.5.2.9	3.12.5.3.9	Hand Controllers	N/A	ME-031		Equipment has no hand controllers.
3.3.6.50A	6.4.5.3A	3.12.5.3A	Valve Controls - Low-Torque Valves	✓	ME-033		
3.3.6.50B	6.4.5.3B	3.12.5.3B	Valve Controls - Intermediate-Torque Valves	✓	ME-033		
3.3.6.50C	6.4.5.3C	3.12.5.3C	Valve Controls - High-Torque Valves	✓	ME-033		
3.3.6.50D	6.4.5.3D	3.12.5.3D	Valve Controls - Handle Dimensions	✓	ME-033		
3.3.6.50E	6.4.5.3E	3.12.5.3E	Valve Controls - Rotary Valve Controls	✓	ME-033		
3.3.6.51	6.4.5.4	3.12.5.4	Toggle Switches	N/A	ME-034		Equipment has no toggle switches.
3.3.6.52A	6.4.6.1A	3.12.6.1A	Stowage Drawer Contents Restraints - Items do not Float	N/A	ME-036		Not responsible for stowage design.
3.3.6.52B	6.4.6.1B	3.12.6.1B	Stowage Drawer Contents Restraints - Items do not Jam Drawer	N/A	ME-036		Not responsible for stowage design.
3.3.6.52C	6.4.6.1C	3.12.6.1C	Stowage Drawer Contents Restraints - Items Removal/Replacement	N/A	ME-036		Not responsible for stowage design.
3.3.6.54	6.4.6.3	3.12.6.3	Captive Parts	✓	ME-036		
3.3.6.55	6.4.6.4.1	3.12.6.4.1	Handles and Restraints	N/A	ME-037		No handles required.
3.3.6.56	6.4.6.4.2	3.12.6.4.3	Handle Location/Front Access	N/A	ME-037		No handles required.
3.3.6.57	6.4.6.4.3	3.12.6.4.4	Handle Dimensions	N/A	ME-037		No handles required.
3.3.6.58A	6.4.6.4.4A	3.12.6.4.5A	Non-Fixed Handles Design Requirements - Stop Position	N/A	ME-037		No handles required.

✓ - Requirement is applicable E - Exception N/A - Requirement is not applicable

ISS PRESSURIZED PAYLOAD INTERFACE REQUIREMENTS DOCUMENT VERIFICATION MATRIX (Cont'd)

SRD Section	LS-71000A Section	SSP 57000 Section	Requirement	Applicable	GPVP VDS #	Responsibility	Comments
3.3.6.58B	6.4.6.4.4B	3.12.6.4.5B	Non-Fixed Handles Design Requirements - One Hand Use	N/A	ME-037		No handles required.
3.3.6.58C	6.4.6.4.4C	3.12.6.4.5C	Non-Fixed Handles Design Requirements - Locked/Unlocked Indication	N/A	ME-037		No handles required.
3.3.6.59B	6.4.9.1B	3.12.9.1B	Electrical Hazards - Exposure hazard exceeds threshold for shock	N/A	EL-041		Equipment has no internal voltages above 32 Vdc.
3.3.6.59C	6.4.9.1C	3.12.9.1C	Electrical Hazards - Exposure hazard exceeds threshold for shock and threshold of let-go profile	N/A	EL-041		Equipment has no internal voltages above 32 Vdc.
3.3.6.59D	6.4.9.1D	3.12.9.1D	Electrical Hazards -Two dependent controls provided	N/A	EL-041		Equipment has no internal voltages above 32 Vdc.
3.3.6.59E	6.4.9.1E	3.12.9.1E	Electrical Hazards -Three independent hazard controls	N/A	EL-041		Equipment has no internal voltages above 32 Vdc.
3.3.6.60A	6.4.9.1.1A	3.12.9.1.1	Mismatched - Reversed Connection	N/A	ME-019		Equipment has no electrical connectors.
3.3.6.60B	6.4.9.1.1B	3.12.9.1.1	Mismatched - Blind Connections	N/A	ME-019		Equipment has no electrical connectors.
3.3.6.60C	6.4.9.1.1C	3.12.9.1.1	Mismatched - Mismating	N/A	ME-019		Equipment has no electrical connectors.
3.3.6.60D	6.4.9.1.1D	3.12.9.1.1	Mismatched -Minimizing Equipment Risk	N/A	ME-019		Equipment has no electrical connectors.
3.3.6.61	6.4.9.1.2.1	3.12.9.1.4.1	Device Accessibility	N/A	EL-013		Equipment has no overload protection.
3.3.6.62	6.4.9.1.2.2	3.12.9.1.4.2	Extractor-Type Fuse Holder	N/A	EL-013		Equipment has no overload protection.
3.3.6.63	6.4.9.1.2.3	3.12.9.1.4.3	Overload Protection Location	N/A	EL-013		Equipment has no overload protection.
3.3.6.64	6.4.9.1.2.4	3.12.9.1.4.4	Overload Protection Identification	N/A	EL-013		Equipment has no overload protection.
3.3.6.65	6.4.9.1.2.5	3.12.9.1.4.5	Automatic Restart Protection	N/A	EL-013		Equipment has no overload protection.
3.3.6.66A	6.4.9.10A	3.12.9.10A	Audio Displays - False Alarms	N/A	ME-044		Equipment has no audio displays.
3.3.6.66B	6.4.9.10C	3.12.9.10C	Audio Displays - Operability Testing	N/A	ME-044		Equipment has no audio displays.

✓ - Requirement is applicable E - Exception N/A - Requirement is not applicable

APPENDIX B

ISS PRESSURIZED PAYLOAD INTERFACE REQUIREMENTS DOCUMENT VERIFICATION MATRIX (Cont'd)

SRD Section	LS-71000A Section	SSP 57000 Section	Requirement	Applicable	GPVP VDS #	Responsibility	Comments
3.3.6.66C	6.4.9.10D	3.12.9.10D	Audio Displays - Manual Disable	N/A	ME-044		Equipment has no audio displays.
3.3.6.67	6.4.9.11	3.12.9.12	Egress	✓	Safety		
3.3.6.68		3.12.4.3.10	Fluid and Gas Line Connectors	✓			
3.3.6.69	6.4.6	3.12.6	Restraints and Mobility Aids	✓	ME-035		
3.3.8.1A1	6.3.1.3.A	3.1.1.3A	Structural Design Requirements – Positive Margins of Safety for MPLM Launch and Landing	N/A	ST-001		Not applicable for stowed hardware.
3.3.8.1B	6.3.1.3B	3.1.1.3B	Structural Design Requirements – Positive Safety Margins for On-orbit Loads	✓	ST-001		
3.3.8.1.1	6.3.1.3C	3.1.1.3D	Structural Design Requirements – Crew Induced Load Requirements	✓	ST-002		
3.3.8.1.2	6.3.1.1	3.1.1.5A	Safety Critical Structures Requirements	N/A	ST-001 ST-002 ST-003 ST-004 ST-008 ST-009 ST-010		Equipment has no safety critical structures.
3.3.8.3.1	6.2.7.2	3.7.5	Pressurized Gas Bottles	N/A	FD-028		Equipment has no pressurized gas bottles.
3.3.8.3.2	6.2.7.3	3.7.6	Manual Valves	✓	ME-048		

✓ - Requirement is applicable E - Exception N/A - Requirement is not applicable

APPENDIX C

FUNCTIONAL PERFORMANCE VERIFICATION MATRIX

APPENDIX C
FUNCTIONAL PERFORMANCE VERIFICATION MATRIX

SRD Section	LS-71000A Section	Requirement	Applicable	Comments
3.2.1.1A	N/A	Accommodate Novel insole (sizes P-Z)	✓	
3.2.1.1B	N/A	Provide a stable, uniform load and pressure release mechanism	✓	
3.2.1.1C	N/A	Pressure range of 0 to 75 psig	✓	
3.2.1.1D	N/A	Protection against overpressurization	✓	
3.2.1.1E	N/A	Pressure display	✓	
3.2.2.1		Mass Properties	✓	
3.2.2.2.1		Stowed Envelope	✓	
3.2.2.2.2		Deployed Envelope Dimensions	✓	
3.2.3A	7.2	Reliability, Quality, and Non-Conformance Reporting	✓	
3.2.3B	7.3.1	Reliability, Quality, and Non-Conformance Reporting	✓	
3.2.3C1	7.3.2.1	Reliability, Quality, and Non-Conformance Reporting	✓	
3.2.3C2	7.3.2.2	Reliability, Quality, and Non-Conformance Reporting	✓	
3.2.3C3	7.3.2.3	Reliability, Quality, and Non-Conformance Reporting	✓	
3.2.3C4	7.3.2.4	Reliability, Quality, and Non-Conformance Reporting	✓	
3.2.3.1		Failure Propagation	✓	
3.2.3.2	7.2.1	Useful Life	✓	
3.2.3.2.1		Operational Life (Cycles)	✓	
3.2.3.2.2		Shelf Life	✓	
3.2.3.2.3		Limited Life	✓	
3.2.4.1.2A	N/A	Relief Valve Verification	✓	Performed every 2 years on the ground.
3.2.4.1.2B	N/A	Bladder Replacement	✓	Performed every 2 years on the ground.
3.2.4.1.2C	N/A	Pressure Gauge Battery Replacement	✓	Performed every 2 years on the ground.
3.2.4.1.2D	N/A	Leak Test Following Bladder Replacement	✓	Performed every 2 years on the ground.

✓ - Requirement is applicable E - Exception N/A - Requirement is not applicable

APPENDIX C
FUNCTIONAL PERFORMANCE VERIFICATION MATRIX (Cont'd)

SRD Section	LS-71000A Section	Requirement	Applicable	Comments
3.2.5.1.5C2	6.3.1.2A	Pressure Rate of Change – Carrier (Orbiter)	✓	
3.2.6.1	6.3.1.3	Launch and Landing	✓	
3.2.7.3.2A	6.3.3.2B	HRF Software Requirements – Software Execution Environment	N/A	Equipment has no software.
3.2.7.3.2B	6.3.3.2C	HRF Software Requirements – Repeatable Software Executable Results	N/A	Equipment has no software.
3.2.7.3.2C	6.3.3.2D	HRF Software Requirements – Display and Graphics Commonality Standards (DGCS)	N/A	Equipment has no software.
3.2.7.3.2D	6.3.3.2E	HRF Software Requirements – Real-time Data Formatting	N/A	Equipment has no software.
3.2.7.3.3	6.3.3.3	ISS C&DH Services Through HRF Common Software Interface	N/A	Equipment has no software.
3.2.7.3.4	6.3.3.2A	CSCI Adaptation Requirements	N/A	Equipment has no software.
3.3.6.2.1A	6.4.3.5.1	Rack Mounted Equipment - Color	N/A	Equipment is stowed hardware.
3.3.6.2.1B	6.4.3.5.1	Rack Mounted Equipment - Finish	N/A	Equipment is stowed hardware.
3.3.6.2.1C	6.4.3.5.1	SIR Drawer Panel Handle Latches - Finish	N/A	Equipment is not a drawer.
3.3.6.2.2A	6.4.3.5.2A	COTS Equipment Non-repackaged - Finish	✓	
3.3.6.2.2B	6.4.3.5.2B	COTS Equipment Repackaged - Finish	✓	
3.3.6.2.3	6.4.3.5.3	Soft Goods - Color	✓	
3.3.6.3B		Full Size Range Accommodation – COTS Equipment	✓	
3.3.8.1A2	6.3.1.3A	Structural Design Requirements – Positive Margin of Safety for Orbiter Launch and Landing	✓	
3.3.8.2.1	6.3.2.10	Batteries	✓	
3.5.3.1	7.3.3	Acceptance Data Package (ADP)	✓	
3.5.3.1.1	7.3.3	ADP Statement in SOW	✓	

✓ - Requirement is applicable E - Exception N/A - Requirement is not applicable

APPENDIX D

ACCEPTANCE AND QUALIFICATION TEST APPLICABILITY MATRICES

APPENDIX D

TABLE D-1. ACCEPTANCE AND QUALIFICATION TEST APPLICABILITY MATRIX

SRD Section	LS-71000A Section	Requirement	Applicable	SRD Verification Section	Comments
3.4.1	5.4.1.1.6.1 and 5.4.1.1.6.2	Nominal Operation Under Thermal Environment	✓	4.3.1.1, 4.3.1.2	
3.4.2	5.4.1.1.3.2 and 5.4.1.1.3.3	Vibration	✓	4.3.2.1, 4.3.2.2	
3.4.3		Functional Performance	✓	4.3.3	
3.4.4	5.4.1.1.10	EEE Parts Control, Selection, and Burn-in	✓	4.3.4	
3.4.5	5.4.1.1.8	Flammability	✓	4.3.5	
3.4.6	5.4.1.1.9	Offgassing	✓	4.3.6	
3.4.7	5.4.1.1.5	Bench Handling	✓	4.3.7	
3.4.8	5.4.1.1.1	Payload Mass	✓	4.3.8	
3.4.9	5.4.1.2.1	EMI/EMC	✓	4.3.9	
3.4.10	5.4.1.1.7	Acoustic Noise	✓	4.3.10	
3.4.11		PDA	✓	4.3.11	

✓ - Requirement is applicable E - Exception N/A - Requirement is not applicable

TABLE D-2. NON-CRITICAL HARDWARE
QUALIFICATION TEST REQUIREMENTS

Component Type Test	FGI Flight Calibration Unit P/N SEG33110402-301	Battery Kit P/N SED46107213-302
Thermal Cycling 7.5 Cycles	✓	
Qualification for Acceptance Vibration	✓	
Flammability	✓	✓
Offgassing	✓	✓
Bench Handling	✓	
Payload Mass Control Plan	✓	
EMI/EMC Control Plan	✓	
Acoustic Noise Control Plan	✓	
EEE Parts Screening	✓	
EEE Parts Control	✓	

✓ - Requirement is applicable E - Exception N/A - Requirement is not applicable

TABLE D-3. NON-CRITICAL HARDWARE
ACCEPTANCE TEST REQUIREMENTS

Component Type Test	FGI Flight Calibration Unit P/N SEG33110402-301	Battery Kit P/N SED46107213-302
Thermal Cycling 1½ Cycles	✓	
Acceptance Vibration	✓	
Functional	✓	
Burn-in	✓	
PDA Functional	✓	✓

✓ - Requirement is applicable E - Exception N/A - Requirement is not applicable

APPENDIX E

JHB 8080.5 DESIGN GUIDANCE MATRIX

APPENDIX E

JHB 8080.5 DESIGN GUIDANCE MATRIX

	SECTION III			
		JHB 8080.5 DESIGN GUIDANCE SECTION		
No.	Standard #	Abbreviated Requirement	App.	Comments
	GENERAL			
	G-1	Equipment Accessibility for Maintenance	✓	Inspect drawing, design, and hardware
	G-2	Separation of Redundant Equipment	N/A	Critical Equipment Requirement
	G-3	Systems Checkout Provisions	E	Not cost effective for non-critical equipment
	G-4	Protection of Spacecraft Electrical and Mechanical Systems from Debris	✓	Inspect drawing and design
	G-5	Interior Design of Spacecraft for Cleanliness	N/A	Vehicle Requirement
	G-6	Redundancy Requirements	✓	
	G-7	Time Displays	E	Time displays on non-critical equipment are based on the display needs, not a generic time displays requirement.
	G-8	Redundant Paths - Verification of Operation	N/A	Critical Equipment Requirement.
	G-9	Shatterable Material - Exclusion From Habitable Compartment	✓	Inspect H/W Item drawing and design
	G-10	Control of Limited- Life Components	✓	
	G-11	Procurement Document Identification for Manned Space Flight Vehicle Items	N/A	Not a design requirement
	G-12	Application of Previous Qualification Tests	✓	
	G-13	Shipping and Handling Protection for Space Flight Hardware	✓	
	G-14	Identification and Classification of Flight and Non-flight Equipment	✓	
	G-15	Equipment Failure - Verification of Flight Readiness	N/A	Not a design requirement

✓ = Applicable N/A - Not Applicable E = Exception

APPENDIX E

JHB 8080.5 DESIGN GUIDANCE MATRIX (Cont'd)

	SECTION III			
		JHB 8080.5 DESIGN GUIDANCE SECTION		
No.	Standard #	Abbreviated Requirement	App.	Comments
	G-16	Operating Limits on Temperature - Controlled Equipment	N/A	Not a design requirement
	G-17	Separate Stock for Space Flight Parts and Materials	✓	Reference assembly TPSs and ADP for evidence of traceability
	G-18	Safety Precautions - Test and Operating Procedures	✓	Audit Test Procedures
	G-19	Special Processes - Identification of Drawings	✓	Review Drawings. Applicable to Class I flight equipment only.
	G-20	Spacecraft Equipment - Protection from System Liquids	N/A	Vehicle Requirement
	G-21	Spacecraft Equipment - Moisture Protection	✓	Applicable to pressurized compartment
	G-22	Parts Identification	✓	Reference assembly TPSs and ADP for evidence of traceability
	G-23	Pressure Garment Wiring - Ignition of Materials by Electrical Current	N/A	No pressure garment in FGI FCU.
	G-24	GSE and Airborne Support Equipment Protective Devices	N/A	GSE Requirement
	G-25	Thermal Design and Analysis - Thermal Parameters	✓	
	G-26	Internally Generated Radiation	✓	
	G-27	Fire Control	✓	
	G-28	Sealing - Solid Propellant Rocket Motors	N/A	SRM Requirement
	G-29	Reentry Propulsion Subsystem In-Flight Test	N/A	Vehicle Requirement
	G-30	Switch Protection Devices	✓	

✓ = Applicable N/A - Not Applicable E = Exception

APPENDIX E

JHB 8080.5 DESIGN GUIDANCE MATRIX (Cont'd)

	SECTION III			
		JHB 8080.5 DESIGN GUIDANCE SECTION		
No.	Standard #	Abbreviated Requirement	App.	Comments
	G-31	Detachable Crew-Operated Tools - Restriction in Spacecraft	N/A	Tools are not used for controls.
	G-32	Measurement Systems That Display Flight Information to the Crew - Indication of Failure	N/A	Critical Equipment Requirement.
	G-33	Surface Temperatures	✓	
	G-34	Extravehicular Activity Electronic Connectors	N/A	EVA Requirement
	G-35	Enclosure Panels External to the Habitable Modules	N/A	EVA Requirement
	G-36	Thermal Blankets - Extravehicular Activity	N/A	EVA Requirement
	G-37	Verification of Adequate External Visibility	N/A	Vehicle Requirement
	G-38	Pressurization or Repressurization - Precluding Ingress of Undesirable Elements	N/A	Vehicle Requirement
	G-39	Lightning Protection Design	N/A	Vehicle Requirement
	G-40	Radioactive Luminescent Devices	✓	
	G-41	Acoustic Noise Criteria	✓	
	G-42	Solar Wind Environment	N/A	Vehicle Requirement
	G-43	Centralized Subsystem Controls	N/A	Vehicle Requirement
	G-44	Attitude Control Authority	N/A	Vehicle Requirement
	G-45	Solid Propellant Rocket Motors - Ignition Capability with Unsealed Nozzle	N/A	SRM Requirement
	G-46	Separation Sensing System - Structural Deformation	N/A	Vehicle Requirement
	G-47	Gyroscopes - Verification of Rotational Speed or Drift Rate	N/A	Vehicle Requirement

✓ = Applicable N/A - Not Applicable E = Exception

APPENDIX E

JHB 8080.5 DESIGN GUIDANCE MATRIX (Cont'd)

	SECTION III			
		JHB 8080.5 DESIGN GUIDANCE SECTION		
No.	Standard #	Abbreviated Requirement	App.	Comments
	G-48	Onboard Experiments - Required Pre-installation Checklist	✓	
	G-49	Temperature and Pressure Monitoring Requirements of Hydrogen Peroxide Systems	N/A	Critical Equipment Requirement
	G-50	Direct Procurement of Parts	E	Not cost effective for non-critical equipment.
	G-51	Flight Hardware - Restriction on Use for Training	N/A	Not a design requirement.
	G-52	Reuse of Flight Hardware	✓	
	ELECTRICAL			
	E-1	Mating Provisions for Electrical Connectors	N/A	The FGI FCU has no electrical connectors.
	E-2	Protection of Severed Electrical Circuits	N/A	Vehicle Requirement
	E-3	Electrical and Electronic Devices - Protection from Reverse Polarity and/or Other Improper Electrical Inputs	N/A	Not cost effective for non-critical equipment.
	E-4	Electrical Connectors - Moisture Protection	N/A	Not cost effective for non-critical equipment.
	E-5	Electrical Connectors - Pin Assignment	N/A	The FGI FCU has no electrical connectors.
	E-6	Corona Suppression	✓	
	E-7	Tantalum Wet Slug Capacitors - Restriction on Use	✓	Review Hardware drawings and design
	E-8	Electrical and Electronic Supplies and Loads - Verification Tests	N/A	GSE Requirement
	E-9	Electrical Circuits - De-energizing Requirements	✓	Review Drawings, Design, and Test Procedures
	E-10	Cleaning of Electrical and Electronic Equipment	✓	

✓ = Applicable N/A - Not Applicable E = Exception

APPENDIX E

JHB 8080.5 DESIGN GUIDANCE MATRIX (Cont'd)

	SECTION III			
		JHB 8080.5 DESIGN GUIDANCE SECTION		
No.	Standard #	Abbreviated Requirement	App.	Comments
	E-11	Protective Covers or Caps for Electrical Receptacles and Plugs	N/A	The FGI FCU has no electrical connectors.
	E-12	Electrical Connectors - Disconnection for Troubleshooting and Bench Testing	N/A	GSE Requirement
	E-13	Bioinstrumentation Systems - Crew Electrical Shock Protection	✓	Review Drawings and Design, Test protection circuits as part of PDA.
	E-14	Electrical Wire Harness - Dielectric Tests	✓	Ref. Assembly TPS
	E-15	Electrical Power Distribution Circuits - Overload Protection	✓	Review hardware item design and drawings
	E-16	Testing Protective Devices for Solid-State Circuits	N/A	Critical Equipment Requirement
	E-17	Electrical and Electronic Piece Parts - Closure Construction	✓	
	E-18	Circuitry for Automatic Shutdown of Launch Vehicle Engine(s)	N/A	Critical Equipment Requirement
	E-19	Equipment Design - Power Transients	✓	
	E-20	Control of ESD for Electronic Parts and Assemblies	✓	
	E-21	Electrical Connectors	N/A	The FGI FCU has no electrical connectors.
	E-22	Ionizing Radiation Effects	✓	
	E-23	Transistors - Selection of Types	✓	
	E-24	Electrical Wire and Cable Acceptance Tests	✓	
	FLUIDS			
	F-1	Flow Restriction Requirements - Pressurized Sources	✓	

✓ = Applicable N/A - Not Applicable E = Exception

APPENDIX E

JHB 8080.5 DESIGN GUIDANCE MATRIX (Cont'd)

	SECTION III			
		JHB 8080.5 DESIGN GUIDANCE SECTION		
No.	Standard #	Abbreviated Requirement	App.	Comments
	F-2	Moisture Separators in a Zero-Gravity Environment	N/A	Not a requirement, this is a design consideration.
	F-3	Service Points - Positive Protection From Interchangeability of Fluid Service Lines	N/A	Vehicle Requirement
	F-4	Ground Service Points - Fluid Systems	N/A	Vehicle Requirement
	F-5	Fluid Lines - Separation Provisions	N/A	Vehicle Requirement
	F-6	Temperature and Pressure Monitoring Requirements for Potentially Hazardous Reactive Fluids	N/A	Vehicle Requirement
	F-7	Capping of Servicing and Test Ports	✓	
	F-8	Fluid System Components Whose Function is Dependent on Direction of Flow - Protection Against Incorrect Installation	✓	
	F-9	Spacecraft Venting - Induced Perturbing Forces	N/A	Vehicle Requirement. EVA Requirement.
	F-10	Nozzles and Vents - Protection Prior to Launch	N/A	Vehicle Requirement
	F-11	Fluid Supplies - Verification Tests	N/A	GSE Requirement
	F-12	Protection of Pressurized Systems from Damage Due to Pressurant Depletion - GSE and Airborne Support Equipment	✓	
	F-13	Crew Cabin Module Pressure - Venting Restriction	N/A	Vehicle Requirement
	F-14	Crew Cabin Module Ventilating Fans - Protection from Debris	N/A	The FGI FCU has no fans.
	F-15	Separation of Hypergolic Reactants	N/A	Critical Equipment Requirement
	F-16	Fluid Line Installation	N/A	Vehicle Requirement

✓ = Applicable N/A - Not Applicable E = Exception

APPENDIX E

JHB 8080.5 DESIGN GUIDANCE MATRIX (Cont'd)

	SECTION III			
		JHB 8080.5 DESIGN GUIDANCE SECTION		
No.	Standard #	Abbreviated Requirement	App.	Comments
	F-17	Cleanliness of Flowing Fluids and Associated Systems	✓	
	F-18	Pressure Relief Valves - Standardization of Functional Testing	✓	
	F-19	Protection for Tubing, Fittings, and Fluid System Components - Flight Hardware and Associated Equipment	✓	
	F-20	Fluid Systems - Cleanliness	N/A	The FGI FCU is not a fluid system.
	F-21	Purge Gases - Temperature and Humidity Requirements	N/A	Vehicle Requirement
	F-22	Pressure Garments - Protection Against Failure Propagation	N/A	The FGI FCU does not supply pressure to the crew's pressure garments.
	F-23	Qualification Fluid	N/A	Verification Requirement
	F-24	Fluid Systems - Design for Flushing and Draining	N/A	The FGI FCU is not a fluid system.
	F-25	Toxicity - Fluids Contained in Systems in the Crew Compartment	✓	
	F-26	Atmospheric Pressure and Composition Control	N/A	Vehicle Requirement
	F-27	Liquid or Gas Containers - Verification of Contents	N/A	GSE Requirement
	F-28	Use of Halogen Method for Coolant System Leak Detection	N/A	Verification Requirement
	F-29	Filter Protection of Active Fluid Components	N/A	Not a requirement, this is a design consideration.
	F-30	Pressure Relief for Pressure Vessels	✓	

✓ = Applicable N/A - Not Applicable E = Exception

APPENDIX E

JHB 8080.5 DESIGN GUIDANCE MATRIX (Cont'd)

	SECTION III			
		JHB 8080.5 DESIGN GUIDANCE SECTION		
No.	Standard #	Abbreviated Requirement	App.	Comments
	MATERIALS AND PROCESSES			
	M/P-1	Material Selection, Review, and Drawing Sign-off	✓	Review Hardware Item Material Review Cert.
	M/P-2	Flammability of Wiring Material	✓	Review Hardware Item Material Review Cert.
	M/P-3	Toxicity of Materials Used in Crew Compartments - Wire Insulation, Ties, Identification Marks, and Protective Coverings	✓	Review Hardware Item Material Review Cert.
	M/P-4	Metals and Metal Couples - Restriction on Use	✓	Review Hardware Item Material Review Cert.
	M/P-5	Solutions Which Contain Ethylene Glycol - Requirements for Silver Chelating Agent	✓	
	M/P-6	Toxicity - Requirements for Nonmetallic Materials Proposed for Use Within Crew Compartment	✓	Review Hardware Item Material Review Cert.
	M/P-7	Material Detrimental to Electrical Connectors	✓	Review Hardware Item Material Review Cert.
	M/P-8	Leak Detectors - Wetting Agents	✓	
	M/P-9	Breathing Systems - Requirement to Test for Mercury Contamination	N/A	Critical System Requirement
	M/P-10	Liquid Locking Compounds, Restrictions, and Controls	✓	
	M/P-11	Pressure Vessel Documentation	N/A	Not a design requirement. This is a documentation requirement.
	M/P-12	Multi-Layer Blanket Bake-Out	N/A	EVA Requirement
	M/P-13	Pressure Vessel Design	✓	
	M/P-14	Silicate Ester Coolant System Design	N/A	The FGI FCU does not use a silicate ester coolant.

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APPENDIX E

JHB 8080.5 DESIGN GUIDANCE MATRIX (Cont'd)

	SECTION III			
		JHB 8080.5 DESIGN GUIDANCE SECTION		
No.	Standard #	Abbreviated Requirement	App.	Comments
	M/P-15	Mercury - Restriction on Use	✓	
	M/P-16	Restriction on Coatings for Areas Subject to Abrasion	✓	
	M/P-17	Radiographic Inspection of Brazed and Welded Tubing Joints	N/A	Verification Requirement
	M/P-18	Etching Fluorocarbon Insulated Electrical Wire	✓	
	M/P-19	Spacecraft Material - Restriction on Use of Polyvinyl Chloride	✓	
	M/P-20	Titanium or its Alloys - Prohibited Use With Oxygen	✓	
	M/P-21	Beryllium - Restricted Use Within Crew Components	✓	
	M/P-22	Brazed Joints - Identification Marks	N/A	Vehicle Requirement
	M/P-23	Pressure Vessels - Materials Compatibility and Vessel Qualifications Tests	✓	
	M/P-24	Cadmium - Restriction on Use	✓	
	M/P-25	Pressure Vessels - Nondestructive Evaluation Plan	✓	
	M/P-26	Repair of Sandwich - Type Structures	✓	
	MECHANICAL AND STRUCTURAL			
	M/S-1	Equipment Containers - Design For Rapid Spacecraft Decompression	✓	Review drawings and design, Test if necessary
	M/S-2	Alignment of Mechanical Systems	✓	
	M/S-3	Wire Bundles - Protective Coating	✓	

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APPENDIX E

JHB 8080.5 DESIGN GUIDANCE MATRIX (Cont'd)

	SECTION III			
		JHB 8080.5 DESIGN GUIDANCE SECTION		
No.	Standard #	Abbreviated Requirement	App.	Comments
	M/S-4	Hatches - Repeated Use	N/A	Vehicle Requirement
	M/S-5	Threaded Fittings - Restrictions on Release of Particles and Foreign Materials	✓	
	M/S-6	Exposed Sharp Surfaces or Protrusions	✓	
	M/S-7	Windows and Glass Structure	✓	
	M/S-8	Penetration of Inhabited Spacecraft Compartments	N/A	Vehicle Requirement
	M/S-9	Mechanisms	E	The first requirement is not cost effective for non-critical equipment. Items 2 and 3 are not applicable for non-critical equipment.
	M/S-10	Functional Doors That Operate in Flight	N/A	Vehicle Requirement
	M/S-11	Meteoroid Protection Levels for Structures	N/A	Vehicle Requirement
	M/S-12	Spacecraft Recovery Hoist Loops	N/A	Vehicle Requirement
	M/S-13	Lifting and Hoisting GSE Identification	N/A	GSE Requirement
	M/S-14	Structural Analysis	✓	
	M/S-15	Stainless Steel Tubing - Method of Joining	✓	
	M/S-16	Pressure Vessels - Negative Pressure Damage	✓	
	PYROTECHNIC			
	P-1	Explosive Devices - Arming and Disarming	N/A	The FGI FCU contains no pyrotechnic devices.
	P-2	Pyrotechnic Devices - Preflight Verification Tests at Launch Sites	N/A	The FGI FCU contains no pyrotechnic devices.
	P-3	Wire Splicing	N/A	The FGI FCU contains no pyrotechnic devices.

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APPENDIX E

JHB 8080.5 DESIGN GUIDANCE MATRIX (Cont'd)

	SECTION III			
		JHB 8080.5 DESIGN GUIDANCE SECTION		
No.	Standard #	Abbreviated Requirement	App.	Comments
	P-4	Explosive Devices - Packaging Material	N/A	The FGI FCU contains no pyrotechnic devices.
	P-5	Explosive Devices - Identification Requirements	N/A	The FGI FCU contains no pyrotechnic devices.
	P-6	Protection of Electrical Circuitry for Explosive Devices Employing Hot Bridge Wire Initiators	N/A	The FGI FCU contains no pyrotechnic devices.
	P-7	Explosive Devices - Color Coding Requirements	N/A	The FGI FCU contains no pyrotechnic devices.

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